AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

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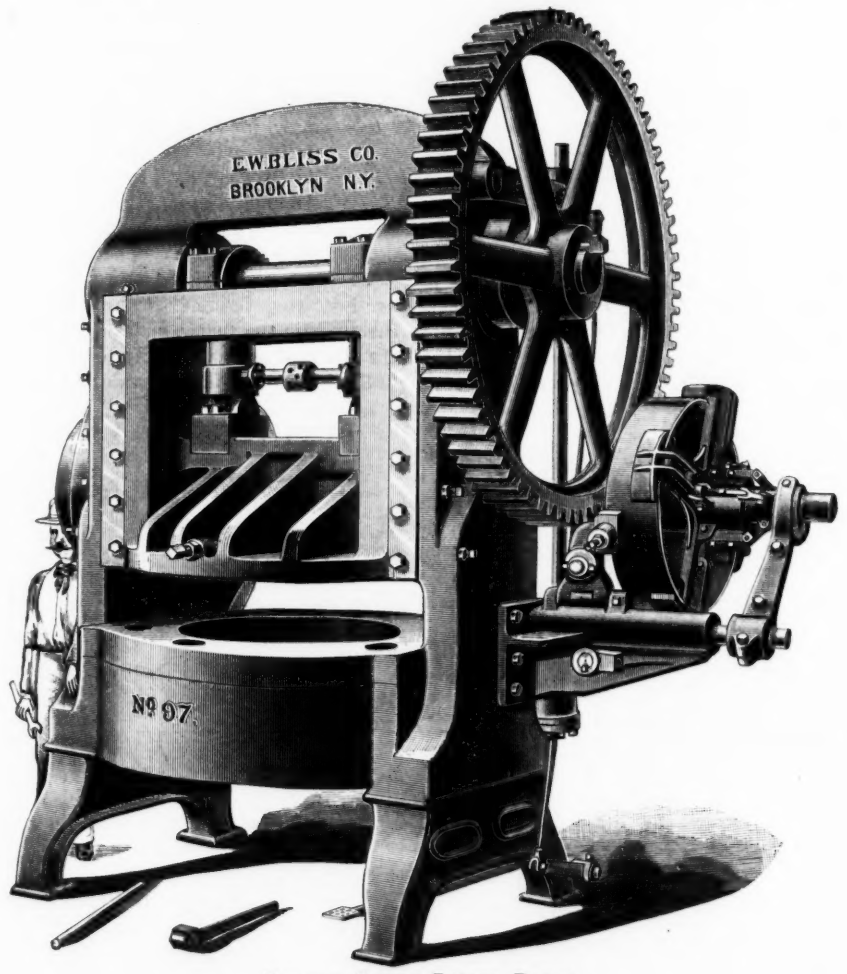
Double Crank Power Press.

With this we give a perspective and a detail view of a double crank power press, possessing in its construction several important improvements suggested by the wide range of experience of its builders, and greatly adding to the efficiency of the machine. It is designed for operating large and accurate cutting and perforating dies, such, for instance, as are extensively used for the manufacture of armature disks and sections for electric motors and dynamos. In this machine the ways of the slide are spread apart so as to be as wide as the frame itself, and the ordinary center gib has been abandoned so as to give a firm support and accurate guidance to the large and delicate dies. This has also made it possible to lengthen the ways considerably without increasing the height of the frame.

A very important feature is the application to the geared presses of this type of the automatic friction clutch, shown in detail in Fig. 2, page 2. By the application of this clutch as below described several difficulties are overcome in the use of heavy back geared presses. The clutch *C* is keyed to the shaft, and when thrown into action it engages with the loose pulley *P*. To throw this clutch into action, a pressure is brought on the foot treadle *a*, thereby actuating the bell crank *b* and disengaging the latch *l*, allowing the weighted rod *r* to drop, which, engaging with the lever *d*, releases the pressure of the brake *f* on the pulley *P*, puts the clutch into action with the flange of the pulley and transmits motion to the pinion *M* and the large spur wheel *N*; this, of course, gives a downward stroke to the slide. During its upper stroke, the pressure on the treadle being removed, the latch *l* springs into its former engagement with the rod *r*, causing the latter to be lifted upwards by means of the cam *i*, so that after the shaft has made a complete revolution the friction clutch will be released, throwing into action at the same time the brake *f*, and thus stopping the slide at the highest point of the stroke.

The large spur wheel, instead of revolving continuously, is, with this clutch at a standstill until the clutch is thrown into action. This constitutes an additional advantage, in the saving of considerable wear on the shaft and wheel hub. Care has been taken in the construction of the clutches to reduce their liability of getting out of order to a minimum, and for whatever wear may be occasioned by continuous use, easy means of compensation are provided. These presses are built by E. W. Bliss Co., No. 1A Adams street, Brooklyn, N. Y.



DOUBLE CRANK POWER PRESS.

Forty-one-inch Pattern Makers' Lathe.

The engraving herewith represents a heavy, substantial pattern makers' lathe, built by Fay & Scott, Dexter, Me. The particular lathe we show was built for the Farrell Foundry and Machine Co. It will take in 24 feet between centers, and swing 41 inches, and fairly represents a line of these lathes made by the firm named, with any desired length of bed and any swing up to 66 inches.

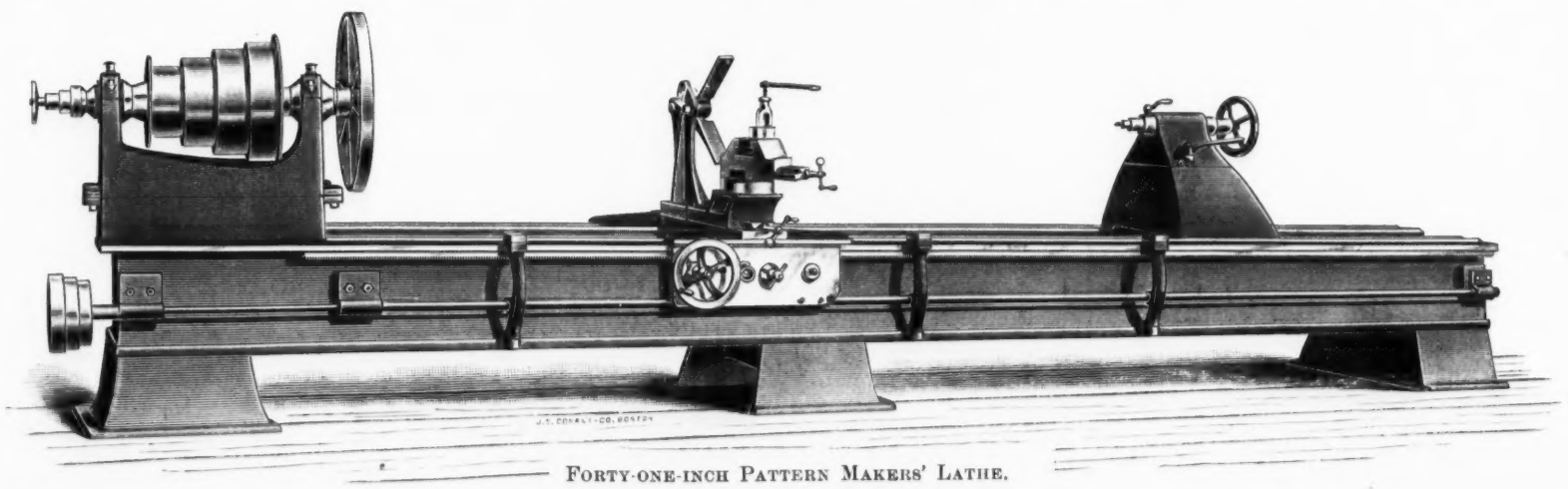
The head-stock swivels for turning tapers and carries a spindle with front bearing 3 inches diameter and 6 inches in length; spindle is bored for center "Morse taper," No. 4.

The face-plate is fitted to the spindle on a feather, and is drawn back to the collar by means of a rod passing through the spindle and fitted with a hand-wheel at the end, a collar recessed in the front face of face-plate forming the nut.

The carriage is fed in either direction by power. The compound rest is graduated in degrees. The follow rest is attached to the carriage by means of a gib, and is readily adjusted to the work. Cone pulley on spindle carries a 4-inch belt. Largest step of cone 17 inches diameter.

The countershaft has iron cone and two friction pulleys of different sizes, giving eight changes of speed.

The lathe shown weighs 9,000 pounds.



FORTY-ONE-INCH PATTERN MAKERS' LATHE.

Explosion of the Feed Pipe Casing on the "Great Eastern."

BY W. F. DURFEE.

The very interesting account of the reparation of the Steamer Great Eastern, by Mr. E. S. Renwick, printed in the AMERICAN MACHINIST for June 1st, calls to mind some facts communicated to me by the late A. C. Hobbs, who was on board of the great ship at the first attempt to launch, and was also present as one of the invited guests on the trial trip when the feed pipe casing of the forward smoke stack exploded.

The vessel was built with its length parallel to the river, and consequently had to be launched sideways. The general mechanical preparations for the launch consisted in supporting the vessel upon two immense cradles, which rested upon ways having a slope of 1 in 12. Abutting against each of these cradles was a huge hydraulic jack (their rams were 10 and 12 inches diameter,) whose function was to start the movement of the immense mass (which weighed over ten thousand tons,) towards the river. Each cradle was also provided with heavy hold back chains, which were wound around a pair of enormous windlass barrels, having friction brakes attached. The purpose of these chains, windlasses and friction attachments was to check a too rapid movement of the vessel down the ways, and to prevent its having too great velocity when it entered the water. Mr. Hobbs said that the failure of the launch was due to the humane consideration of Sir J. K. Brunel, the designer of the vessel, who was personally in charge of the launching operations. Mr. Brunel, at the instant the ship commenced to move, became aware that, owing to the inefficient policing of the river, there were several excursion steamers filled with people, and also a number of small boats directly in the line of movement of the ship, and instantly apprehending that if the vessel continued its movement into the water, great loss of life must inevitably ensue, he gave the signal to apply the brakes; this was done, and the ship brought to a standstill after moving but a few feet. But, un-

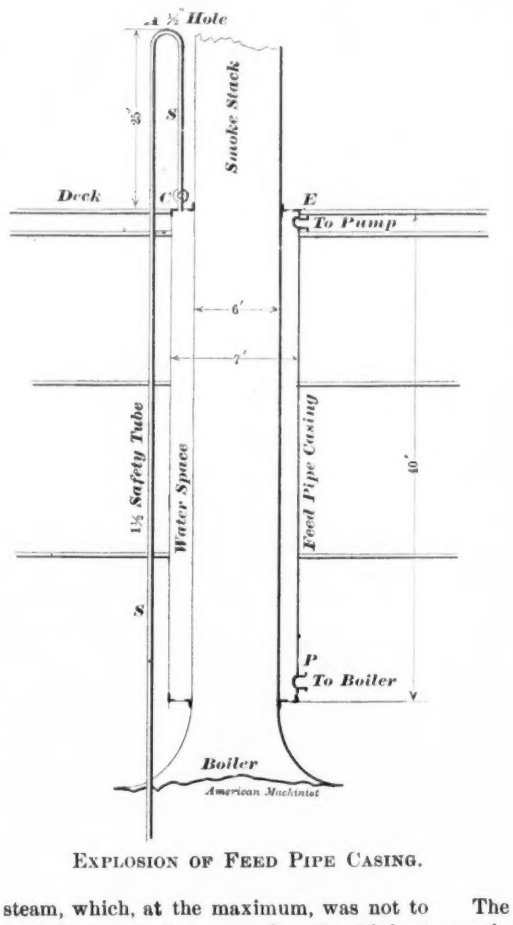
fortunately, the brakes did not act equally upon the two cradles, and therefore one end of the ship did not cease to move as soon as the other, which resulted in cramping and disarranging the cradles with reference to the ways, and this, combined with an actual subsidence of the foundation on which the ways rested, prevented the ship being launched by a sliding movement due to gravity, and she was eventually pushed by slow degrees into the water by the use of a number of powerful hydraulic jacks. A number of months and an enormous sum of money were expended in getting the ship into the water (launching it cannot properly be called,) and although the first attempt to launch the ship was made on the 3d of November, 1857, she was not ready for her trial trip until the 10th of September, 1859; eighty-nine days of this time were occupied in getting the vessel afloat, at a cost of £60,000; the whole cost of the vessel up to this time, including the operation of floating, having been £640,000.

Mr. Hobbs stated that on the trial trip he noticed that the wind caused one of the forward smoke stack stays to give out a very sharp musical note, indicating that it was under severe strain; he immediately called the attention to it, who sent a man and slacked off the buckle screws. A short time after this, Mr. Hobbs was sitting near the bow of the ship, conversing with some friends, when he saw the forward smoke stack leap into the air amid an immense volume of steam, and then fall upon deck, and although there was a dull explosion, and evidently a great disaster, such was the solidity of the vessel, there was absolutely no jar or tremor felt.

Seven men were killed and seven wounded by this accident, the first origin of which was criminal ignorance on the part of some one or more persons in authority.

The construction, which was the immediate cause of this fatality, is illustrated by the sectional sketch herewith.

The smoke stacks of the boilers which supplied steam to the paddle engines were six feet in diameter, and from a point just above the boilers, for forty feet of their height, were inclosed in cylinders of iron seven feet in diameter, connected steam-tight to the funnel at top and bottom. This enveloping cylinder was called a feed pipe casing, and it was intended to serve two purposes: first, to prevent the radiation of heat from the smoke stack to the woodwork and fittings in the immediate vicinity of the stack, and second, to utilize the heat that would otherwise be wasted, by passing all the feed water for the boilers through this casing, the water entering from the pump at the nozzle *E*, and passing to the boilers from the nozzle at *P*. Apparently to insure safety against any formation of steam or undue pressure within the feed pipe casing, there was a 1½-inch pipe *S* secured to the top of it, and this pipe was carried twenty-five feet above the deck, and then bent in a semi-circle and returned downward, its lower end being open in the stoke-hole; the pipe had a half-inch opening to the atmosphere at the top of the bend at *A*, and was provided with a cock at *C*; there was also a valve in the pipe connecting the bottom nozzles *P* of the feed pipe casing with the boilers, which could be closed if, for any reason, it was desired to feed them with cold water. The feed pipe casing and its attached safety tube *S* were intended to be of such height that the water therein would force itself by gravity into the boilers against the pressure of steam, which, at the maximum, was not to exceed twenty five pounds (the highest pressure carried during the trial trip was 21½ pounds,) and any steam generated within the feed pipe casing was expected to manifest itself at the half-inch hole in the top of the bend of the safety tube (that is, if the cock *C* was open as it was intended to be whenever the boilers were under steam) and if the feed pumps continued to pump into the feed pipe casing after it had been shut off from the boiler by closing the valve in the pipe connecting with the nozzle *P*, the feed water would immediately call attention to this fact by a discharge at the lower end of the safety tube in the stoke-hole. Thus intention specified that the apparatus should perform; but unfortunately, it was found that when the pressure in the boilers exceeded seventeen pounds, the feed pumps gave a great deal of trouble, and an attempt was made to overcome this by cutting off the connection of the feed pipe casing with the boilers by closing the valve in the pipe connecting with the nozzle *P*, and turning the cold water directly into the boilers through a branch pipe arranged for that purpose. It was supposed that at the time the feed was turned directly into the boiler, some one through ignorance closed the cock *C*, but it did not appear at the inquest that any order had been given for so doing, and no person testified who knew that it was closed, but it was found so after the explosion, and a similar cock on the other feed pipe casing (which did not explode) was also found closed.



EXPLOSION OF FEED PIPE CASING.

The closing of the valve in the pipe connecting the bottom of the feed pipe casing with the boiler and the shutting of the cock *C* in the safety-pipe, left the feed pipe casing full of water to generate steam, destruction and death, at leisure; and in due time the smoke stack collapsed under the pressure, the stack and casing being ruptured transversely (partly through a line of rivets, and partly through solid metal) about ten feet above the boiler, then thrown aloft and deposited on deck, as before mentioned.

On examination of the stack and feed pipe casing, it was found that there were *no stay bolts whatever* uniting the casing to the stack, and for the whole forty feet of its length the feed pipe casing was in no way connected to the stack save at the ends. The pressure of the bottled-up water in the feed pipe casing will never be known, but it is not at all wonderful that disaster resulted from such a construction so mismanaged.

The coroner's inquest failed utterly to fix the responsibility for the use of the feed pipe casing, or for its peculiar construction, but it was decisively established that it was employed in opposition to the strongly expressed protest of John Scott Russell, the builder of the ship.

As is usual in case of boiler explosions, there were some very peculiar theories advanced to explain the result. One gentleman (well known as an inventor of boilers, who at that time held an official position as a government inspector of steam vessels) declared that "there must have been some gas generated in the feed pipe casing, which, when the stack collapsed, took fire"; but to the credit of English science, Professor Faraday testified that it was impossible for any explosive gas to be generated under the conditions which existed, in which view he was supported by several other witnesses of eminence. It appeared in evidence that one gentleman—who was to be the chief engineer of the ship when she was put on regular service—had spent twenty-three months in studying its engines and other mechanical appliances, and had not discovered why the cock *C* was placed in the safety pipe, and although he was on board during the trial trip, he denied that he had any responsibility, saying that the ship was being run by the contractor, who in his turn declared that the company's engineers were in charge. This point was never cleared up, but the jury brought in a verdict which amounted to:—*Nobody knows how it happened, and nobody is to blame for not knowing.*

It has been altogether too common for English critics to sneer at American marine steam engineering, and to advertise liberally what they regard as our want of knowledge in that field of engineering practice. Some of the criticism is doubtless deserved, and due attention to it will certainly do no harm; but American engineers are not alone among the fathers of blunders, and it is a fact that there is not to be found from the time of John Fitch to the present, in all the practice of American marine steam engineers, so conspicuous an example of utter carelessness and stupidity in design and operation as the responsible engineering talent employed upon the "Great Eastern" allowed to pass under their hands in the feed pipe casings of that vessel, and no American republicratic jury ever white washed a republicratic criminal half as thickly as the English coroner's jury did the responsible designers of the blunders described.

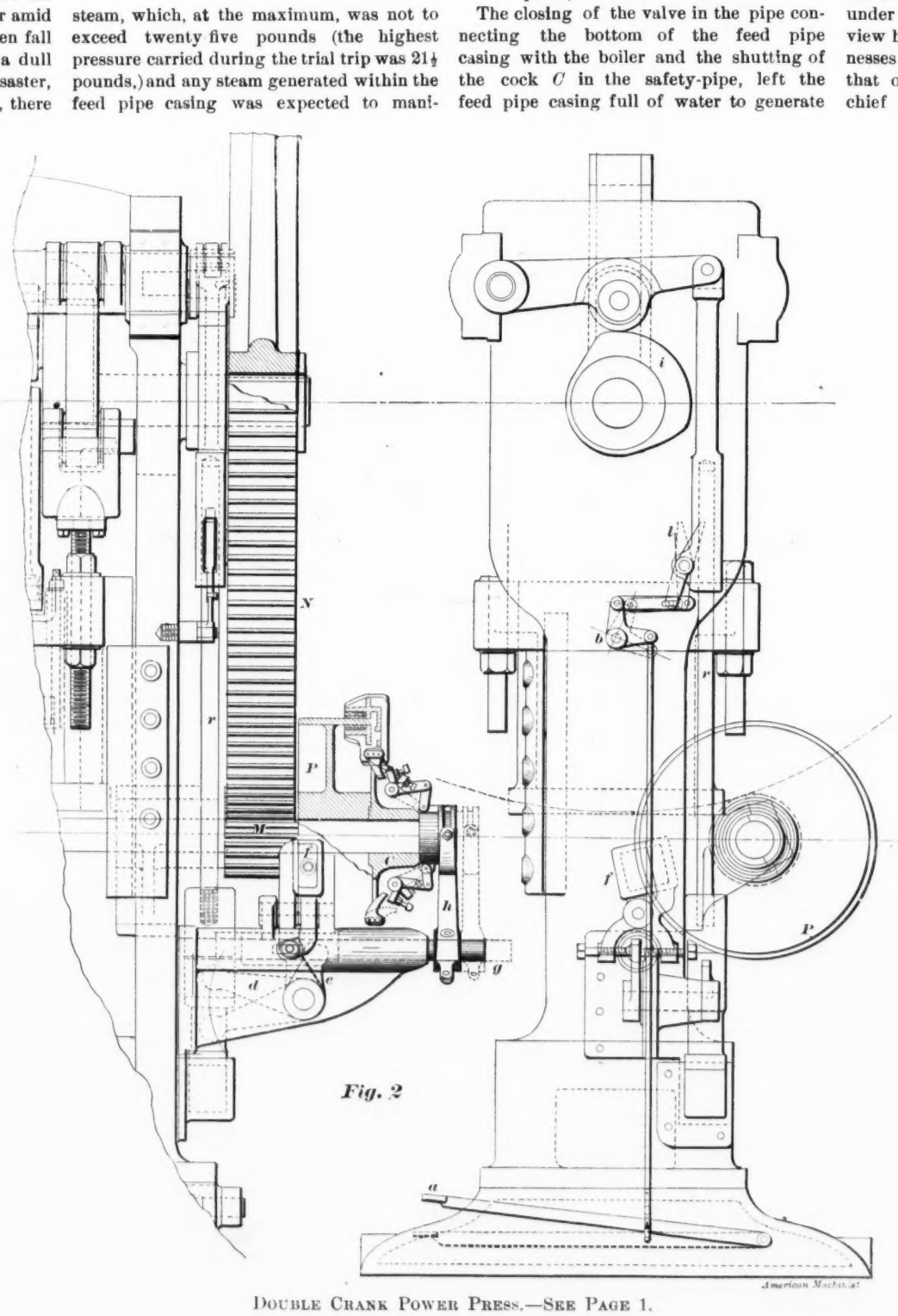


Fig. 2

DOUBLE CRANK POWER PRESS.—SEE PAGE 1.

On failure of the owner of baggage to remove same from a depot after a reasonable opportunity, the company acquires the capacity of a warehouseman, and is liable only for lack of ordinary care; and where a passenger, on arrival at her destination, left her trunk, for convenience and economy, at the station, though with the agent's consent, but took a small portion of the contents thereof

with her, the company's liability as carrier ceased, and that as warehouseman began.—*Decision of Supreme Court of Texas.*

Columbian Exhibition Notes—VI.

Editorial Correspondence.

DICK & CHURCH ENGINE.

At Fig. 22 is an engine which attracts much attention here, not only because of its prominent position, but also because of its remarkable neatness and smooth running at high speed. It is a Dick & Church engine, and was built by the Phœnix Iron Works Co., Meadville, Pa It is a four-cylinder, triple-expansion, with high-pressure cylinder, 15″, intermediate, 24″, and the two low-pressures, 26″ diameter; 18″ stroke. It runs at 200 revolutions, and is designed for 500 horse power, its work here being to drive two 250 horse-power Eddy generators. There are three pulleys on the crank shaft, one of these being in the center, and the other two overhung at either side. Belts can be run on all three of the pulleys, though here they are running them on the outside ones only, which are 9 feet diameter for 24″ belts. Within the central pulley is the governor, which in this case is double, *i. e.*, there are two complete governors which are placed side by side within the wheel, but they are connected so that they act together as one governor. The cut off is automatically varied on all four cylinders.

By reference to our issues of June 16, '88, and Sept. 24, '91, full particulars can be obtained regarding the special features of this engine, and it is sufficient at this time to say that its most distinctive feature is in the construction of the bed in such a manner that the cylinders are all overhung, and are yet all supported independently of each other, so that they are not only relieved of undue transverse strain, and are free to expand by the action of heat independently of each other, but any one of them is accessible and can even be removed from the engine without disturbing the others. This is accomplished by making the bed in two parts, one of which bolts to the top of the other, each of these parts having a hood to which its cylinder is bolted. Distance pieces and tie rods at the top, as shown, add to the rigidity of the construction.

Piston valves are used, and the valve chests are bushed with sleeves in which the ports are formed, these sleeves being readily renewable when worn, and the valves being of the double-piston form, without rings, as shown by sections published in our issue of June 16, '88, referred to above.

The valve stems, instead of being carried through the high-pressure steam chests and back to the low-pressures, are carried around them, as it were, by the introduction of rock shafts, this arrangement doing away with the necessity for off sets, and relieving the connections of all side strain or tendency to cramp.

Though lagging is largely a matter of taste merely, it is quite generally agreed that the lagging on the cylinders, steam chests and steam pipe of this engine is particularly neat and attractive. It consists merely of cast plates with parallel ribs as shown, the tops of these ribs being finished (presumably by grinding), while between the ribs there is paint.

The cranks are of the disk form, and when running are covered by russia-iron shields, these being removed at my request to show the cranks and as much of the rod as possible. Practically all the working parts that need attention are easily accessible from the iron platform, and attached to this there is a lever which works a pawl by which the engine can be turned off the center.

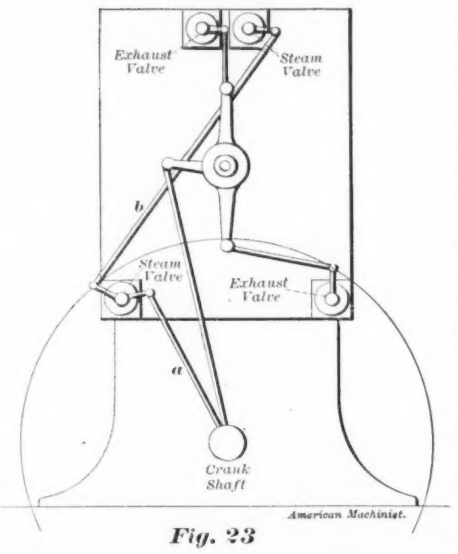


Fig. 23

"REYNOLDS' NEW DEPARTURE."

There is running here a vertical compound engine, which is driving a line of shafting, and attracts a great deal of attention on account of its novel form and evidently novel method of working; but curiosity concerning it is very incompletely satisfied for the reason that it is regarded by its builders as still in the experimental stage, and in reply to inquiries concerning it, they say that many of its details may have to be altered, and they do not care to say anything about it yet.

I may, however, properly give such information concerning it as may be gathered from an inspection of it as it runs, and a little conversation with the discreet young man who is in charge of it.

As before remarked, it is a vertical compound engine, and in some respects it resembles the Corliss, while in others it differs radically from the Corliss and from all other engines that I know anything of. There is but one piston, the high-pressure steam acting upon this during the up stroke, and the low pressure steam at the down stroke.

Some idea of the way the engine appears may be gained from the sketch, Fig. 23, which is not to scale. There are two eccentrics side by side on the crank-shaft. From one of these a wrist-plate motion is derived for moving the exhaust valves in the manner indicated, these valves having an oscillating motion the same as in the usual Corliss motion. The steam valves, however, are not moved from the wrist-plate, but direct from the other eccentric through the connections *a* and *b*, the levers for these two valves not being keyed to the stems, but driving them by means of ratchets and pawls, there being five teeth in the ratchets, and the valves therefore having an intermittent rotary motion in one direction, and making a revolution to every five revolutions of the engine. The governor is throttling, and any horizontal cross-section of the engine as it appears would be rectangular in outline.

An idea of the arrangement of the piston and cylinder may be obtained from Fig. 24, in which *a* is the piston, and is seen to be in the form of an inverted cup, to which the rod is attached at *b*, there being no piston rod. The outside diameter of this piston is 26″, and its inside diameter 18″; the high-pressure steam acting upon this ring, 26″ diameter outside and 18″ inside, after which it is exhausted to the top, where it acts upon the full area of 26″. The stroke is 16″, and the engine is designed to run at 175 revolutions. The trunk *c* which is inside the piston and through which the connecting rod works, is flanged at the bottom and bolted to the lower end of the cylinder.

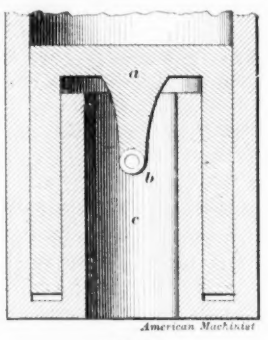
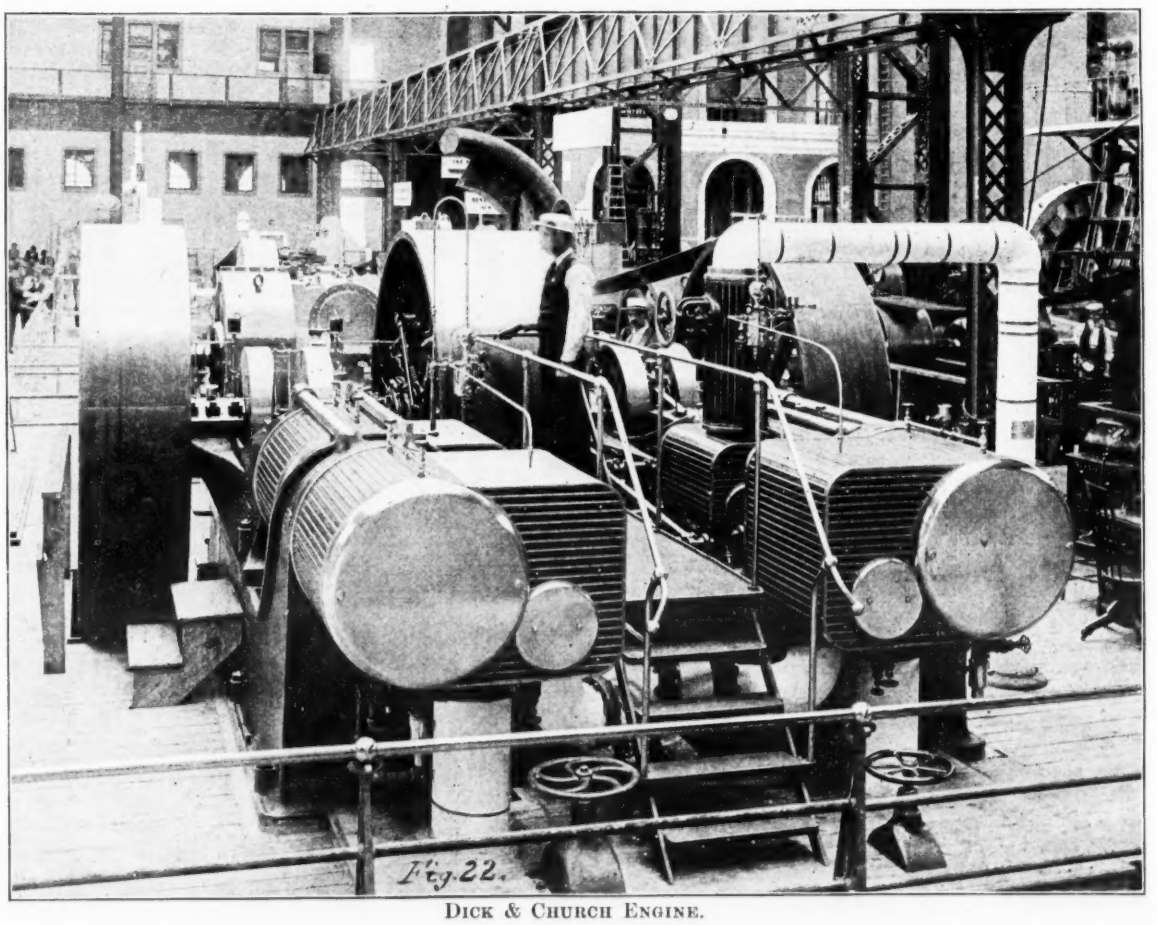


Fig. 24



DICK & CHURCH ENGINE.

THE INTRAMURAL POWER PLANT.

In my first communication I notice a mistake regarding the power plant of the Intramural railroad here. Instead of being located *in* the Forestry Building, it is near that building, and instead of power being derived from an Allis engine alone, it is derived from five different engines, two of which are Allis (Reynolds-Corliss) while of the others there is one Greene, one McIntosh & Seymour, and one Williams, the latter built by the Lake Erie Engineering Co., of Buffalo.

The Greene engine, which is built by the Providence Steam Engine Co., is a tandem compound, with cylinders 28″ and 38″ diameter, 48″ stroke. It runs at 100 revolutions, and drives by belt to a T. H. 500 kilowatt generator, the engine being intended for 750 horse power. Connected with it is a Worthington independent condenser.

Next to this is the McIntosh & Seymour engine, which is tandem compound, with cylinders 13″ and 23″ diameter, 22″ stroke, running at 150 revolutions, and driving direct a T. H. 200 kilowatt generator. The engine is designed for 300 horse-power, and is connected to a Deane Steam Pump Co.'s independent condenser. These two engines are both in service.

Next to them is the largest engine of the plant, but which is not yet running. It is an Allis (Reynolds-Corliss) of 2 000 horse-power. It is a cross-compound, with cylinders 32″ and 62″ diameter, 60″ stroke. It will run at 76 revolutions, and is direct coupled to the generator, the armature of which is attached by a flange and bolts to the hub of the fly-wheel.

Next comes the Williams, which is named for its designer, an old contributor to our columns, and now chief engineer for the Lake Erie Engineering Co., of Buffalo. It is a vertical cross compound, with cylinders 22″ and 44″ diameter, 36″ stroke, running at 100 revolutions, and direct connected to a T. H. 750 kilowatt generator. This engine will probably be the subject of an illustration in the near future.

Lastly comes a tandem compound Allis, with cylinders 22″ and 42″ diameter, 48″ stroke, running at 80 revolutions, and developing 750 horse power.

There are at one side of the building a row of ten Babcock & Wilcox boilers, which supply the steam for the plant, the fuel being oil, for which there is a system separate from that of the Exposition power plant. Each boiler is designed to furnish steam for 250 horse-power at a pressure of 125 pounds. Boiler feeding is done by a Gould Steam Pump Co.'s and a Smith & Vaile pump. The chief engineer of the plant is Mr. G. H. Klumph, and the chief electrician, Mr. C. H. Macloskie, who is a son of President Macloskie of Princeton College, which college is quite well represented in the enterprise, one of the novelties of the power house being the sight of young workmen going about with gray woolen shirts bearing across the breast in large letters the legend (familiar on many baseball and footbal grounds) "Princeton."

THE ROAD.

This Intramural railway is one of the most interesting engineering features of the Exhibition, and is probably a much nearer approach to what is needed for such service as that of the Manhattan Elevated road in New York, and the Metropolitan Elevated here in Chicago than has been achieved up to this time. The road, which is double tracked and three and a half miles long, is upon an elevated structure of wood, and has grades of 2 per cent., and curves of 100 feet radius. Four cars are run in each train, the motors being placed upon the forward or motor car only, the other three being trailers. The current is conducted along the track by means of a third rail which is at the side of the others, there being a brass shoe which slides along on this rail and conducts the current to the motors. There is a motor on each of the four axles of the motor car, each motor being capable of exerting 133 horse-power, and classed by the builders (the Thompson-Houston Company) as L. W. P., 20-25, which, being interpreted, means light water proof, 20

pounds at 25 miles per hour, which being further interpreted means that at a speed of 25 miles per hour the motor is capable of exerting upon the axle a horizontal force of 20 pounds.* There is one reduction by gearing from the armature to the axle, which has wheels 36″ diameter, arranged in the usual manner under two trucks, the distance from center to center of these trucks being 37 feet 6″, and from center to center of wheels of each truck 5 feet 6″. The ratio of the gearing is 58.17, so that a high rotative speed of the armature is secured, and the desired amount of power without excessive weight. The ordinary cars weigh 27,000 pounds each, and the motor car practically twice that amount, making the whole weight of the train 135,000 pounds. Each car, including the motor car, will comfortably seat 90 persons, and there is standing room for a good many more, which is intended to be utilized when there is a rush. The weight on each wheel of the motor car, empty, is about 3½ tons, but an advantage of the system is that this weight is increased as the train fills up, people going into the motor car as freely as any other, so that when the greatest tractive force needs to be exerted, the weight is correspondingly increased, and this weight is a paying weight. The New York Air-brake is used, the air being compressed by a pump which is driven by an independent electric motor on the motor car.

Mr. W. E. Baker, who is manager of the road, has had considerable experience with the West End system in Boston, and says that this road and its equipment has been designed in the light of his and others' experience there, and in his opinion, while it is not perfect, it is a long step in advance, and that experience which will be gained with it during the summer will enable contracts to be entered into with confidence for such work as the equipment of the elevated roads referred to above.

Referring to the experiments of Leo Daft on the elevated roads of New York, he thought that these were well carried out, probably as well as they could have been at that time, but that Daft was simply too far ahead of general electrical development, that this road represented better practice for no other reason than that there had been a great advance in electrical engineering—an advance which must be credited to many different men. He thought this advance would continue, especially in the direction of making electrical apparatus to be used in transportation less like instrument work, and more like machinery, and consequently better able to stand the service. The controlling apparatus on the motors of the Intramural road constitute the weak point in the rolling stock, and for no other reason than that they have been made instruments rather than machines.

The large Allis engine of this plant, Mr. Baker thinks, represents the nearest approach to perfection in an engine for such service that has ever been attained, and this is so simply because it has been designed in the light of experience gained with a large engine by the same builders in the West End plant. The load in this work must always vary greatly and the proportions of the cylinders and the ratio between the high and low-pressure cylinders had been fixed after an exhaustive study and comparison of hundreds of diagrams taken from the Boston engine, working under every possible range of conditions.

Again in the matter of the proportion between the engine and the dynamo it is to drive, the impression had been and still is in some quarters that the engines should have a surplus of power over that which can be absorbed by the dynamo. Experience had shown that this is erroneous and that the dynamo should be capable of absorbing more power than the engine can possibly develop, thus enabling the full power of the engine to be always available without danger of injuring the dynamo, the efficiency curve of the dynamo, unlike that of the engine, being practically the same whether fully loaded or not.

In such service it had been good practice to use a certain form of fuel economiser, even under conditions where it would not save a pound of fuel in the manner it was intended to save it, but simply because the economiser carried a large body of water which it kept hot and ready to be rapidly evaporated in the boiler when there was a temporary extra demand for power above what the boilers could continuously supply.

In its more even distribution of the weight of the train throughout its entire length; in the fact that the weight of the motor car with its load varies as the train load varies; in the absence of the noise of the exhaust steam and in cleanliness this road has obvious advantages over elevated roads operated by steam locomotives. The conditions here are such that it can be tested thoroughly.

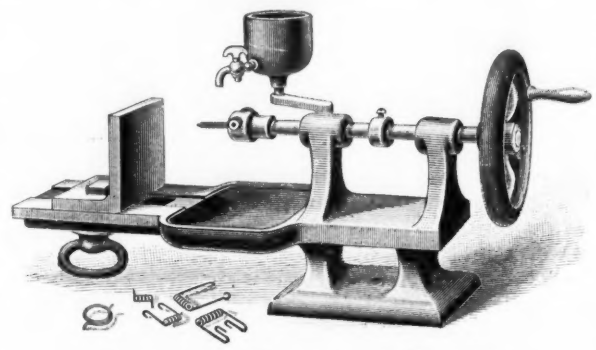
The trains are certainly being operated well at present, though it is expected that points will be developed during the summer's experience that can be improved upon; this being one of the objects which is to be kept in view.

It is entirely probable that in this road and in the electric lighting and power systems to be seen in Machinery Hall, the real electrical exhibit of the Exposition will be found rather than in the Electricity Building.

The great heat of Machinery Hall continues to oppress those whose duties require them to spend their time there, and relief seems slow in coming though protests, petitions and other forms of influence have been brought into play to have matters in this respect improved. A few days ago the heat in the space occupied by the Ashcroft Mfg. Co. reached 115°, and men have become completely exhausted by it, so much so that the object for which they are attending the exhibition is practically defeated. As I believe I have before explained this is due to a combination of steam pipes under the floor, an extensive plant of boilers at the south side of the building with open passage ways between, to the sun shining through the glass overhead, and finally the fact that the ventilators have been closed with canvas to keep out the rain. There are windows near the roof which it seems might easily be pivoted at the center so that they could be opened to secure air; but they are fixed immovably in position, and for some reason the Department of Construction seems equally immovable in the direction of fixing these windows, or to afford any relief whatever; Chief Robinson being helpless in the matter as it does not come under his jurisdiction. He has finally allowed himself to be quoted to the effect that he has written letters and explained the necessity for doing something in the matter to those who should attend to it until he is tired, and that no effect seems to be produced except that an occasional promise is secured. The growling among the exhibitors about the matter is loud and deep, and I think unless it is soon remedied they will be heard from in a manner that will command attention, probably.

I have received a letter from Mr. A. K. Mansfield, mechanical engineer for the Buckeye Engine Company, in which he says that the cylinders of the engine (and of all the Buckeye engines here) are not covered with planished sheet iron as I stated but with sheet-steel $\frac{3}{16}$″, thick rolled to shape. This he regards as a rather important departure in engine designing and much more substantial than a covering of thin sheet iron; all of which is true enough, but the principal difference between planished iron and sheet-steel for a cylinder covering is in the more substantial and durable character of the latter, which does not manifest itself after a few weeks running but only after a year or more of service, and one who merely looks at the engine cannot tell the difference.

He says that the cylinder of the assistant valve mover to which I referred is not 6″ diameter as I gave it but 4½″ diameter and 5¾″ stroke. I gave the diameter as it was given to me by some one connected with the exhibit—practically the only means I had of finding it out. The stroke I did not inquire for as it must evidently be the same as the movement of the valve in whatever engine the device is used on. Mr. Mansfield further says that the cut-off in this cylinder is at one-quarter stroke, and "we look upon this as a feature of importance, its principal function being to impart motion to the valves during the first part of the stroke; that is to overcome the retarding effects of inertia." Points which I am glad to be able to present.



TAPPING AND WIRE-BENDING MACHINE.

Messrs. McIntosh & Seymour also send some further particulars regarding their engine some of which I was not in possession of at the time the account of it was written, and which I should be glad to present were it not for the fact that it is impossible to cover every point of all the engines and other machines which are to be seen here. The best I can do is to give an idea of their most prominent and interesting features, especially those which differ from the common or previous practice. F. J. M.

Jackson Park, June 26.

Asking a question is an indirect but sometimes a rather forcible way of argument. For example, when a correspondent of *Locomotive Engineering* interjects into a discussion by various writers anent the best way of locating and keying eccentrics to locomotive axles before the wheels are under the engine, the question, "Why should we attempt to set eccentrics before wheels are placed under engine?" he might let the case go to the jury without further efforts, and without serious fears of the result.

SPRUE CUTTER.

Tapping and Wire-bending Machine.

This little machine, of which we present an engraving, will undoubtedly be found a useful tool in many shops for tapping small holes, making springs, bending wire, running in screws, and for other purposes. The engraving shows the machine so clearly that little in the way of description is necessary. It has a Pratt chuck screwed to end of spindle. For bending wire it is sometimes necessary to use a face-plate, pins being located in it at suitable points for securing the required form.

The manufacturers are C. H. Redman & Co., Newark, N. J.

Sprue Cutter for Brass Castings.

The sprue cutter shown herewith is built by S. M. York, Cleveland, O. It is designed for hard work, and also in form to permit its use on irregular shaped castings, the bed being in one piece and without legs, permitting obtruding parts to be swung underneath the lower cutter.

The foot-lever is counterbalanced; the motion of cutter is obtained through a knuckle joint, increasing the force at the time the cutters are doing their work.

The stroke of this machine is 1¼ inches, and of the smaller size ¾-inch. Cutters are simple pieces of steel 1x¼ inch.

Why Do Brass Pipes Crack?

BY PETER H. BULLOCK.

The above inquiry may warrant various replies, any of which may be correct if the right conditions existed to produce the undesirable result, such for instance as over-pressure, bending strains due to lack of proper support, or to shocks caused by water hammer. Any of these may prove destructive to the best of pipe, but it is not from any of these causes that the breaks I shall refer to are due, for they have occurred in several cases under very moderate pressures, and where the pipes were entirely free from any external strain or water hammer. I inclose a photo print of a piece of 2″ brass pipe about 4 feet long, (see page 2) which burst under a cold water pressure of but 22 pounds. The pipe had three level supports in 16 feet, was supplied from a tank, and at the time it burst there was absolutely no one in the apartments through which it passed or supplied, and, therefore, its failure cannot be attributed to shock or water hammer. The crack opened about ¼ inch wide, and extended 6 feet. The whole length was removed, and a piece 5 feet long, cut from the other end, stood 200 pounds pressure, and a smart blow from a hammer at the same time without fracture. At the top it will be noticed that the crack goes diagonally to the right. This oblique crack was not a part of the original, but occurred in the forge when the pipe was being heated for the purpose of annealing, it being my intention to cut off and save about 8″ of solid pipe. That the part which cracked was under considerable internal metallic strain there can be no doubt, for a piece 12″ long cut from the bottom of the piece shown, requires a weight of 1,781 pounds to bring the edges of the crack together. The pipe in question is from a lot of about 8,000 feet, in sizes from 2″ to ⅜″, and is used entirely for cold water distribution. It has been in use less than two years, and ten breaks have occurred within the past two months, two of them being in ½″ pipes, and one in a ⅜″ under but 14 pounds pressure. The latter burst in the night when everything was entirely quiet and free from jar of any kind. A remaining piece of the latter stood 300 pounds to the inch—all I had facilities to get and measure.

It seems to me that there is little doubt but what the question of hardness has much to do with fractures in brass pipe, but why

* According to my arithmetic, a force of 20 pounds moving at 25 miles per hour is equivalent to 1.3 horse-power instead of 133 horse-power, and I am not now able to explain the discrepancy between this arithmetic and the figures as given to me, though doubtless there is an explanation for it.

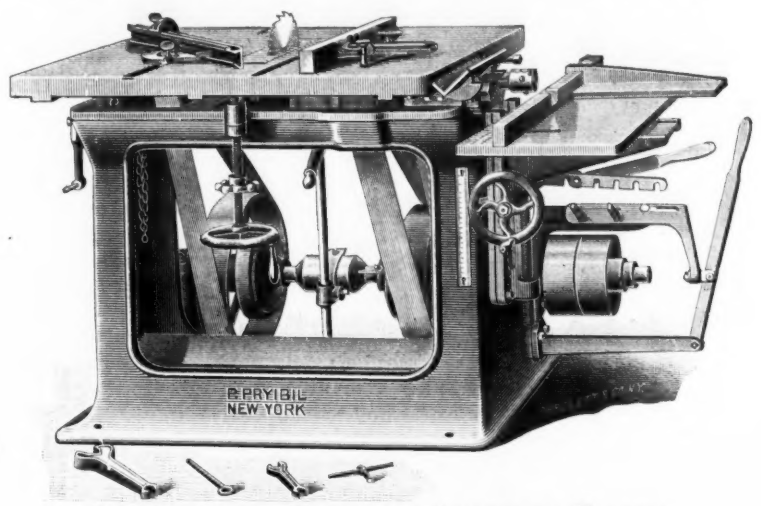
a single piece should show such a variation in strength and other features, I am unable to see. It will be noticed that the split does not follow a line parallel with the axis of the pipe, but diverges over 1" in the part shown, and the rest of the fracture was on about the same spiral. The break when fresh did not show any evidence of a seam, and the metal looked as clean as in another part that was broken for the purpose of comparison. To satisfy my own curiosity, and to enable others to better understand the conditions, the following experiments were made:

The piece above referred to as being pressed together, another similar piece from the other end of the pipe, and two 12" pieces cut from different lengths of the same lot, were tested as to their musical tone under different conditions of hardness, etc. Small holes were drilled near the ends, and they were suspended near a piano, and struck with a small gavel of hard wood, all the tones given being in third octave, 4th line treble cleff. The first piece gave the tone of E sharp when in the same condition as when under pressure. It was slightly heated and allowed to cool in the air. It then gave the tone of D flat, was pressed together by 980 pounds, and did not fully open again. It was then heated to redness, plunged into cold water, and then 160 pounds closed the seam permanently, and it returned an indistinct tone, but too low for comparison with any note of the piano.

Next the piece from the other end of the split pipe was tested, the tone being D flat. It was then planed open lengthwise, but it did not open any, showing that the inside portion of the metal was not in such a state of compression as that in the split part must have been. After being planed open the tone was an imperfect D sharp, and on annealing, the results were about the same as in the first specimen. Of the two other pieces taken from other lots of pipe, one gave the tone of C sharp, and the other of C flat. On planing them open, they seemed to be less brittle than the former pieces, and the tone was not changed to any extent. One of them opened just enough to clear the tool, and the other closed enough to make it impossible to feed the tool through and clean off the edges until the pipe was wedged apart.

These experiments seem to indicate that the inner portion of the metal of the pipe that burst was under a severe compression strain at the point where the break occurred, but that the other end of the same pipe was substantially free from such strain. It also seemed that in some specimens the outside portion was under strain, as the pipe closed slightly when planed open. It also seems that hardness can be ascertained by tone, and we may yet use standard tuning forks for examining pipe before its acceptance. I hope to hear from others who may have had similar trouble, for misery likes company, and it is not reassuring to think of nearly two miles in use, and breaks occurring almost daily.

Now I am far more used to grate bars, crank pins and follower bolts than to musical instruments, terms and cadences, and all I can say for this part of the pipes is that the tone given by the several pipes seemed to be exactly like those given by the piano, and I have innocently written down what the musician said those notes were. I feel a possibility that this little plunge into an unfamiliar subject may make me as ridiculous among those who have musical knowledge as the reporters of the daily papers make themselves among mechanics when they attempt to describe some new piece of machinery, and if it does, I can only promise not to do so any more.



COMBINED SAWING, BORING AND CHAMFERING MACHINE.

Hydraulic Riveting Machines.

In our issue of June 22 we published two letters from England on the above named subject, prefacing them with a few words which we thought necessary to make their purport understood. In a short time we received a letter from an English gentleman, at present in Chicago, who understood our preface to the letters as unintentionally discrediting them. We have not been able to satisfy him to the contrary, and must confess our inability to do so, unless by stating here, as we wrote him personally, viz.: "So far as concerns the letters they stand on their merits, purely and simply, and without prejudice from anything we have said."

If this is not satisfactory we shall have to give it up.

"Star" Head Blocks.

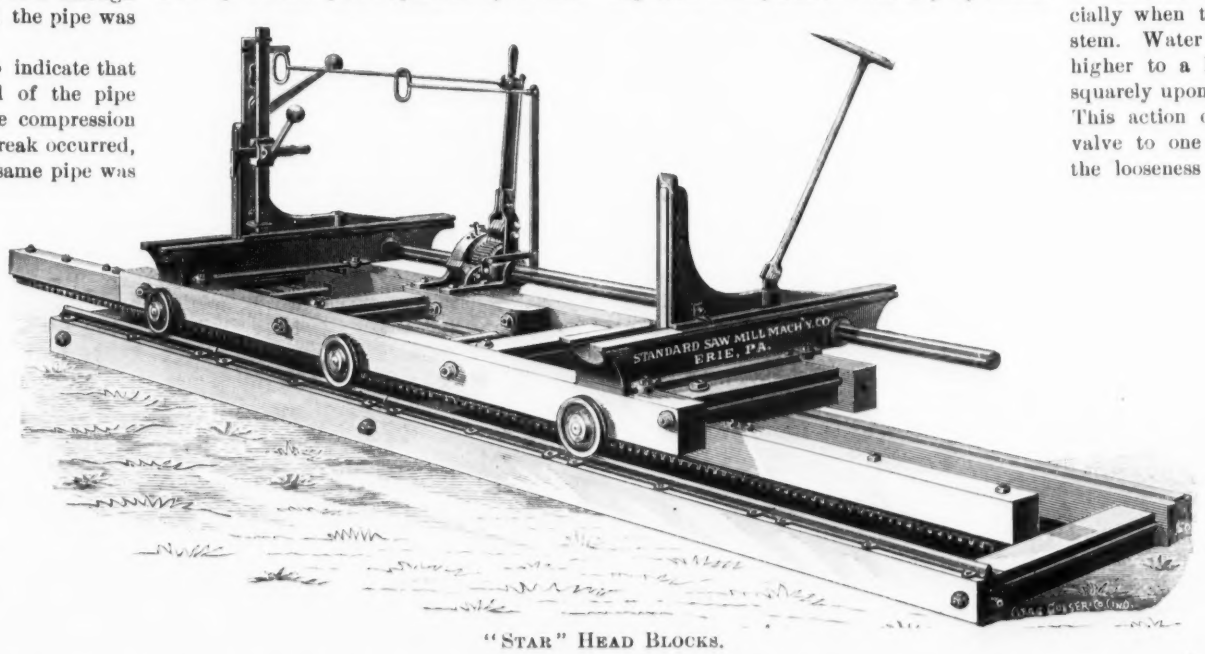
The engraving herewith represents the new head blocks made by Standard Sawmill Machinery Co., Erie, Pa. These blocks are made in one solid casting, scaled and figured for knee to open 40 inches from the saw. The knees are moved simultaneously and remain parallel.

The ratchet wheel is 9 inches diameter, 2¾ inches face and has 60 teeth; it is operated by four steel setting pawls of varying lengths, which are raised from the under side by a steel pawl operated by a half-turn of the setting lever. By one movement the setting pawls are disengaged and the reversing pawl is engaged, enabling the sawyer to move back the knees while at the sawyer's lever.

The check pawls, six in number, prevent back or lost motion; they are operated by the sawyer, being controlled by the other lever which extends across the carriage parallel with the setting lever. The ratchet is also provided with a circle and stop, the circle being scaled and figured for cutting lumber from ¼ inch to 2½ inches in thickness. The ratchet may be set to sixteenths if desired, and can be operated by either the sawyer or the setter with equal convenience.

The blocks are furnished with the new star ratchet, set rod, key seated, one "Excelsior" Knight dog, combining both log and last board dog and one self-supporting hammer dog.

The weight of blocks as shown is about 870 pounds.



"STAR" HEAD BLOCKS.

Combined Sawing, Boring and Chamfering Machine for Wagon and Carriage Makers.*

This machine has been designed especially for wagon makers. It is a small, compact machine carrying a 12-inch circular saw, having loose and tight pulleys for starting or stopping the entire machine, and friction clutches for running the saw or the chamfering cutter independently.

The saw, the chamfering cutter and the boring bit are all carried on separate arbors, running at proper speeds and not interfering with each other. None of them need to be removed to make room for the others, but when it is desired to cut grooves, the circular saw can be replaced by a dado head. The table is hinged at the back and arranged to swing up and down by means of a screw, to give the saw or the dado head any desired depth of cut.

It is provided with a rip-gauge, and with either one or two cross-cut slides. The boring table is adjustable vertically by means of a screw, and it slides to and from the bit by the operation of a hand-lever. It is provided with an adjustable stop to limit the depth of hole bored, and with an adjustable fence and gauge to determine the position of the hole. When so ordered, this table can be made to slide sideways also against adjustable stops; this enables two holes to be bored at a predetermined distance apart without removing the work from the table. The chamfering is done by an independent cutter, which can be set to cut any width up to one inch. All bearings and loose pulleys are self-oiling; bearing caps are planed in lined with the best babbitt metal and provided with back pressure screws.

The machine is self contained on a box-shaped body made in one piece, and not liable to twist out of shape when placed on a weak or uneven floor. A belt shifter is provided which will catch the belt in any direction from which it may come.

Weight, about 700 pounds. Floor space required, 5 feet by 3 feet 2 inches. The tight and loose pulleys are 8 inches diameter for a 3-inch belt, and should make about 765 turns per minute. It is manufactured by P. Pryibil, 498-510 West Forty-first street, New York City.

* Republished from June 15 issue on account of use of wrong engraving.

LETTERS FROM PRACTICAL MEN.

Mud Drum Valves—How the Cylinder Was Broken.

Editor American Machinist:

I read an article recently from an engineer, who claimed that he got rid of the trouble of a leaky mud valve by adding the second valve on the same pipe and close to the old mud valve.

Mud valves on boilers that will persist in leaking are a source of much trouble and annoyance, and the supposition is that every engineer has had his share of such trouble. But it doesn't fall to every engineer's good fortune to hold a position where there is liberality enough to supply two mud valves for a place that one is supposed to fill, while the instances are very rare that require double mud valves. I have no doubt that there are places where they would do good service.

I have filled positions where the mud valves would persist in leaking every time they were opened and closed under pressure; this was easily stopped by driving a pine plug into the mouth of the blow-off p pe, when as soon as the pressure had accumulated in the pipe equal to that in the boiler the valve could be opened and immediately reclosed, and would seat square and tight; the plug could then be taken out and laid away, to be used the next time the valve was operated. This persistent leaking of mud valves is not due to scale and other matter getting between the valve and seat, but is rather due to faulty construction. Valves with a round or oval edge and seat to match will prove very troublesome, especially when they are very loose upon the stem. Water and steam flowing from a higher to a lower pressure does not act squarely upon the back or face of a valve. This action of the water will throw the valve to one side of the seat according to the looseness of the valve upon the stem, and when the oval faced valve strikes the seat there it will persist in sticking. If a valve has a straight beveled edge, say at an angle of 45 degrees, it is easily brought to its place as soon as it comes in contact with the seat; likewise a flat-faced valve will readily square itself to the seat. The oval-faced valve will generally close tight when operated in the absence of pressure or rather in a balanced pressure.

My present position was largely stocked with these troublesome valves. They have been replaced with the flat-faced valves of the Jenkins make, and are giving perfect satisfaction.

This same article referred to aimed to convey the idea that these double mud valves placed tandem on one pipe would

hold their equal share of the pressure, which is not possible.

The first valve leaks, and the second valve is tight, consequently the first valve will continue to leak until the pressure is balanced upon either side, at which time the first valve may be opened without making any difference in the condition of the second valve. Again, the first valve may be opened and immediately reclosed, and the chances are that it would seat all right, and not leak if the second valve was opened and left so.

An article recently appeared in the news columns of a mechanical paper relating an incident where the engineer in charge of a mill caused a little trouble by not looking things over carefully before he started. This particular engine was coupled to the same shaft that was driven by the water wheels. The engineer started up the water wheels, and after he got them going pretty well, went to the engine room to help the wheels out with a little steam. He got there just as the crash came, and he found the cylinder head and the cylinder demolished. Starting the water wheels without uncoupling the engine had converted the engine into a pump, and pumped water over from the boiler in sufficient quantity to smash out the cylinder head, and otherwise do a great amount of damage.

Wonderful, isn't it, how that particular engine could pump water over from the boiler with the throttle valve closed?

A relief valve upon each end of that particular cylinder would have allowed the excessive pressure of air to escape, and prevented that particular crash.

S. A. SMITH.

Height Gauge.

Editor American Machinist:

Inclosed I hand you a sketch of a tool for planer and milling machine use. This tool may not be new to many of your readers, but is certainly not in as general use as it would be if it was more acquainted with. I call it a height gauge, and use it as follows: Suppose a rough piece on a planer is to have a thickness of $1\frac{13}{16}''$, set the planer tool to the gauge at say $1\frac{7}{8}''$, rough it off, set down the tool to the finish of $1\frac{15}{16}''$ by the gauge, and have the thickness correct at once. If both sides of a piece are rough, then rough and finish the one side, allowing for finish on the other; and after finishing one side reduce the other. By the gauge and the "make-up piece" get any thickness to within $\frac{1}{64}''$—finer measurements must be made with still more accurate tools. If a piece measures thicker than 2" (the thickness of the gauge at the largest place), apply under the gauge a parallel strip of known thickness to get the dimension. If a very high piece, set the rough tool to the line struck on the piece at the required place, and back off the tool by the gauge $\frac{1}{32}''$ or more if necessary, and upon passing a rough cut feed the $\frac{1}{32}''$ by the gauge, bringing the work to the right thickness. The advantage in the tool is that duplicate dimensions are easily, quickly and accurately obtained. The dimensions on the gauge are unalterable, and require no setting or adjusting. The gauge is stamped on the side with all the heights, and is hardened and ground. Sketch inclosed is from a gauge of the writer's, and is a great convenience. As it may be of service to other mechanics, I give it for what it is worth.

C. A. BURTON.

Gear Teeth.

Editor American Machinist:

I never had the slightest objection to these handy and lazy gear tooth rules for the purpose of drawing poor gear teeth—such wretchedly poor gear teeth as Mr. Calvert illustrates in your issue of June 29th. Don't ask my opinion, but look at the engraving. Just see how the teeth come together, sharp corners rubbing and scraping on circular arcs, and corners knocking against other corners. Great Scott! what a racket that job would make until the corners got ground down or knocked off.

I have quite a collection of bad gear rules, and this one is the worst and easiest; in fact, the easier they get the worse they are.

I have not the least doubt that there are many as bad or worse gears much more than four years in use, but that does not recommend the rule. I repeat that there is not a decent handy gear rule known, not one which will draw properly working teeth of all sizes and numbers.

Lexington, Mass. GEORGE B. GRANT.

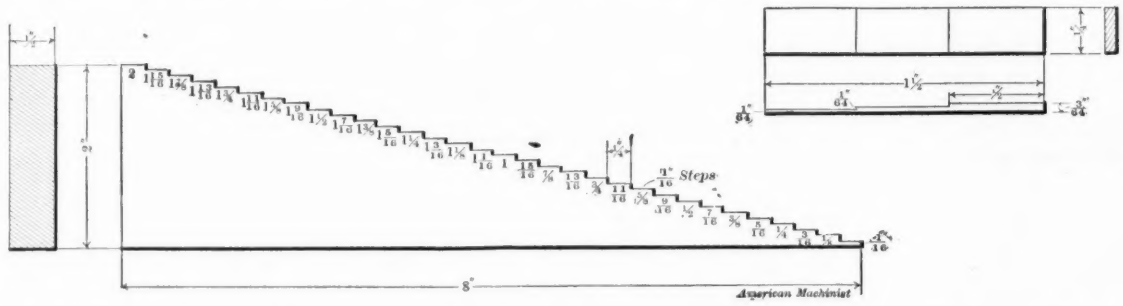
Dynamos.

Editor American Machinist:

Mr. C. J. H. Woodbury has been good enough to explain to the cotton manufacturers some things about the action of the dynamo, which were copied in your issue of May 25th and which have recently come to my notice.

Of late the electrical engineers and mechanical engineers have been manifesting a kindly disputatious tendency to prove how much each knows about the business of the other, and, although nothing of this sort can be imputed to Mr. Woodbury, yet I think there are some points in his paper which a fellow-mechanical engineer may be pardoned, in his ignorance of the science of electricity, for not comprehending.

For instance that any magneto-mechanical action prevented the use of iron wire in the coils of an armature; at all events any such as he refers to when he says of motors the magnets would attract a section of wire in the armature and hold it stationary. It needs only mechanical reflection to see that the resultant turning moment—or "tongue" as the motor men call it—due to any attraction of the fields, or "magnets," as he calls them, in the wires of the hypothetical iron wound armature, would be absolutely zero.



I should think the electrical engineer didn't want to make his armature coils weigh six or seven times as much as and occupy more space than those made of the copper he has used; he didn't want his field to be split into two streams of "attraction" moving parallel to the path of the armature coils, and hence rendering them, whether iron or copper, relatively inoperative.

Mr. Woodbury says "Each of the coils of wire making up a section of the armature is brought into the circuit as its commutator bar comes in contact with the brush and in that way contributes, by being pulled across the attraction of the magnets of the dynamo," and, again farther on, "the electricity is *switched out* of such coils, etc." The italics are mine.

Mr. Woodbury has a large proportion of his motive power "switched out" all the time. What are the rest of his coils about when he has only two at work? I do not understand how he can in any way "switch out" a coil for an instant. They are all hitched up together—"tandem"—and are put there to work, and work all the time. When a coil is not entirely occupied in transforming energy on its own account, it is busily passing along the energy transformed by its neighbors.

The "attraction of the magnets" does not express the truth and has very little to do with the action of the dynamo anyway.

SAND.

Master Mechanics' Committee on Fire-box Steel.

Editor American Machinist:

The majority report of the Committee on Tests of Iron and Steel of the Railway Master Mechanics' Association quoted in your issue of June 29, makes the surprising statement that "certain requirements as to chemical composition, tensile strength and elongation do not insure the best quality of steel for fire-box work." The association is to be congratulated that it had one man on its committee, Mr. Barnes, who was bold enough to present a minority report and place himself on record in favor of proper specifications as to chemical and mechanical tests as more likely to insure the obtaining of good steel than the "judgment" of men who worked the steel and observed its behavior.

If the position taken by the majority of the committee is the true one that in nearly every shop there are men capable of passing on the merits of various sheets of steel from inspection of the fracture, and if they "feel that they have done no small thing in advancing the art of manipulation of steel" if they "succeed by this report in furthering a full and careful investigation of the merits of the expert system," it is incumbent upon this majority to take some further steps toward investigating the merits of this "system" themselves, and not be satisfied merely with presenting a report which will be printed and then forgotten.

The issue is joined between the majority of the committee with those who like them believe in the "judgment" of an "expert" in the fracture of steel as the best means of determining its quality, and the minority, Mr. Barnes, together with his adherents who believe that the framing of correct specifications and their strict enforcement is the best way to secure the best fire-box steel.

The latter way has been tried now for over fifteen years, or ever since the use of open-hearth steel for fire-boxes became general. It has been approved by long practice, and its results we know. The other way, the "judgment of experts," is as yet only a theory. In these days, however, theory should never be despised. The theoretical man often comes out "on top." Let us give him a fair trial. Let us apply the "scientific method" to his theories and place the results against those obtained by the practice of the past fifteen years and see which are the better. Let us make the "full and careful investigation of the merits of the expert system" which the majority of the committee recommend.

How shall this investigation be made? Perhaps the committee has a plan for making it, but, if not, let the following be suggested:

Let them go into one or more locomotive repair shops where old fire-boxes are being repaired or replaced, and get a collection of samples from the old sheets that are being displaced. Get a history of each sheet, and put a private mark on each which shall refer to the history that is to be filed away for future reference. The history might read like the following: *A*, from fire-box of engine No. —— side sheet, five years' service, damaged by accident, otherwise perfect. *B*, sheet badly pitted after six months' service. *C*, sheet cracked after one week's service. *D*, sheet blistered after first trip. *E*, new sheet of fire-box steel from A. B. & Co., whose sheets have never been known to fail. *F*, new sheet from C. D. & Co., whose sheets occasionally crack. *G*, cheap grade of shell steel. *H*, soft tank steel.

Obliterate all surface marks such as pinholes, cracks, etc., by which any one might tell whether the steel had failed or not in service, and paint the surfaces so that all the pieces would look about the same. Then call in a dozen or so of the "experts" and get their separate and individual "judgments" as to the quality of the different samples as determined by the fracture. Then cut the sheets into enough pieces to give one to each expert and let him try it by fire and water and by forging and flanging test and report the result in writing

If the reports of the different experts agree to any reasonable extent it will go far to establish the theory of the majority of the committee. If they still further agree in showing that *A* and *E* are the best pieces of fire-box steel in the lot, that *B* and *C* are the worst, that *F* is only of medium quality, and that *G* and *H* are not fire-box steel at all, then their theory would be almost proved.

But if the theory is correct it should be reduced to practice. The "experts" having proved that they can tell good and bad fire-box steel by the fractures should explain how they do it, and organize some sort of school for instructing the superintendents and inspectors of steel works how to do it—they who have for so many years been slaves to the chemical laboratory and the testing machine. They should frame a specification concerning fractures which the steel manufacturer might try to meet. They should reduce their expert knowledge to writing and write a book upon it, so that when they died their wisdom concerning steel fractures should not die with them.

If the majority of the committee will undertake "this full and careful investigation of the merits of the expert system" and will reduce to practice their theory, then they will have a right to "feel that they have done no small thing in advancing the art of manipulation of steel."

The practical test of the theory might be carried still further. From the same sheets upon which the "experts" have reported cut pieces to be tested in a testing machine and take drillings for analysis, and let a testing laboratory report from the results of these tests which of the steels are the best for fire-boxes.

The writer had some experience from 12 to 14 years ago in a steel works, a brief chapter from which may throw some light on this fire-box steel question. At that time the Otis steel had the reputation of being the best for locomotive fire-boxes, and all the other brands of fire-box steel, while having friends here and there among master mechanics, had their general reputation still to gain. With nearly all these other brands there were occasional complaints of cracked fire-boxes and cracks in flanged heads, while such complaints were almost never heard of in regard to Otis steel. The latter also commanded the highest price in the market. A chemical investigation was made of the difference between Otis and other steels, and it was found that it was the lowest in phosphorus. Taking this fact as a guide the steel works referred to made it a rule to grade and sell as fire box steel only that which was still lower in phosphorus than Otis' average. It also made it a rule to test a clipping from every sheet, by the fire and water test, and a sample of every heat by the testing machine. As a result of this care, during more than two years that the writer was with the concern, it never had a cracked sheet of fire-box steel returned. If there is any better way to control the quality of fire box steel than by following strictly a proper chemical and physical specification the world has yet to learn of it.

WM. KENT.

Says it is a German, Not an Austrian, Exhibit.

Editor American Machinist:

In his letter "Things to See at the Fair," Professor John E. Sweet thinks the iron works of Stumm located in the "far away old fogy Austria." The situation of same is at the banks of the Saar River at Saarbruecken and Saarlouis near Treves, in the Rhine Province, and thus belonging to the

kingdom of Prussia, and, therefore, the Stumm's exhibits are a part of the German, not Austrian, section.

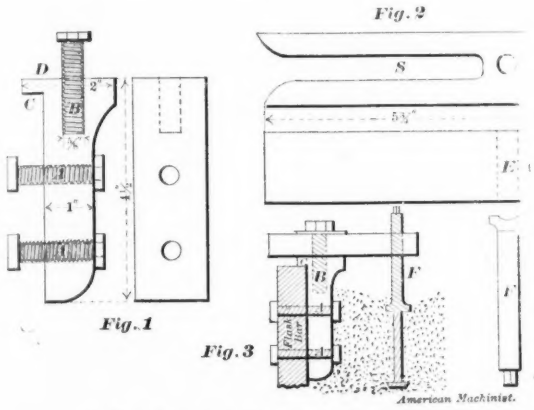
Massillon, O. HENRY C. DUBBEL.

A Device for Holding Chaplets.

Editor American Machinist:

As I was walking through the shop a few day since, I noticed a little scheme for holding chaplets, which is perfect in that it does all the work that is required of it. A boiler for hot water heating was being made. It was composed of tubes 3½″ or 4″ in diameter and ¼ of an inch thick. The flask required was 5 feet by 9 feet and ten chaplets were used. It may be seen that great care must be taken in setting and securing the core to keep the ¼″ in thickness the same in all parts.

Ordinarily in making a casting of this kind, the chaplets would be cut a given length and secured by weights, wedges, binders, clamps, etc. As every foundryman knows, the difficulties are very numerous in securing so many chaplets by the means named. A wedge will get moist and slip; a chaplet will be cut a little long or short, and require several wedges; a weight will be too heavy or too light; a clamp will get loose, and there are many other trials one could mention. This little



A DEVICE FOR HOLDING CHAPLETS.

device of which I speak does away with all these difficulties, besides saving labor in hunting up rigging for every casting.

It is composed of two castings, the patterns for which may be whittled out with a jack-knife, and once made can be taken care of ready for use any time a flask is being fitted up. One casting is made in the shape of a small bracket, Fig. 1, 4½″ long, 2″ on the top face and about 1″ through the center. It has two bolt holes, *A A*, drilled or cast through it to bolt it to the bar in the flask, which may be either wood or iron—of course iron being the most satisfactory if the flask be a large one. A ⅝″ hole *B* is drilled and tapped into the upper end *D* or face of the casting, to admit a machine screw which fastens the piece, Fig. 2, to it, allowing this piece to slip easily around on either side of the bar. The shoulder *C* is allowed to lap over the upper side of the bar, making it perfectly solid and preventing any twist.

The second casting, Fig. 2, is a square strip 5¾″ long, 1½″ square, with a slot *S* cast through it lengthwise ⅝″ wide.

A hole *E* is drilled and tapped through the solid end of this piece to take a screw *F*, which screws down on the head of the chaplet, as shown in Fig. 3. When the core is set on the anchors, and the cope is put on and clamped, a small wrench is used to tighten the screw.

Each chaplet is set independently of the others, and each does its own work independently. If one chaplet is a little short or long it does not require three or four loose wedges to adjust it to the right length, thus increasing the risk to slip. No heavy weight causes the chaplet to crush the core nor to slide off sideways, thus allowing the core to float.

When the casting is taken out of the sand, the piece, Fig. 2, may be easily taken off by loosening the screw *B*, Fig. 1, and put aside for another cast, while the brackets, Fig. 1, may remain bolted to the bars.

When the flask is not in use, and is out in the weather, it may be said that these screws will rust so as to render them unfit for use again; this is not so. The only part that is at all affected is the screw *B*, and should this get a little tight by rust, it may be easily loosened by using kerosene oil.

If the flask gets old and "shook," this bracket may be easily removed and fastened to a new one.

This device will be found to be very useful if regular work is being made, or if there are several castings from the same pattern. Of course, if one odd casting is to be made it cannot be said that this is profitable, otherwise the scheme has proved itself a great help in doing away with a great many risks arising from the old methods. GEO. A. WEBSTER.

The Differential Chain Hoist.

BY I. MCKIM CHASE.

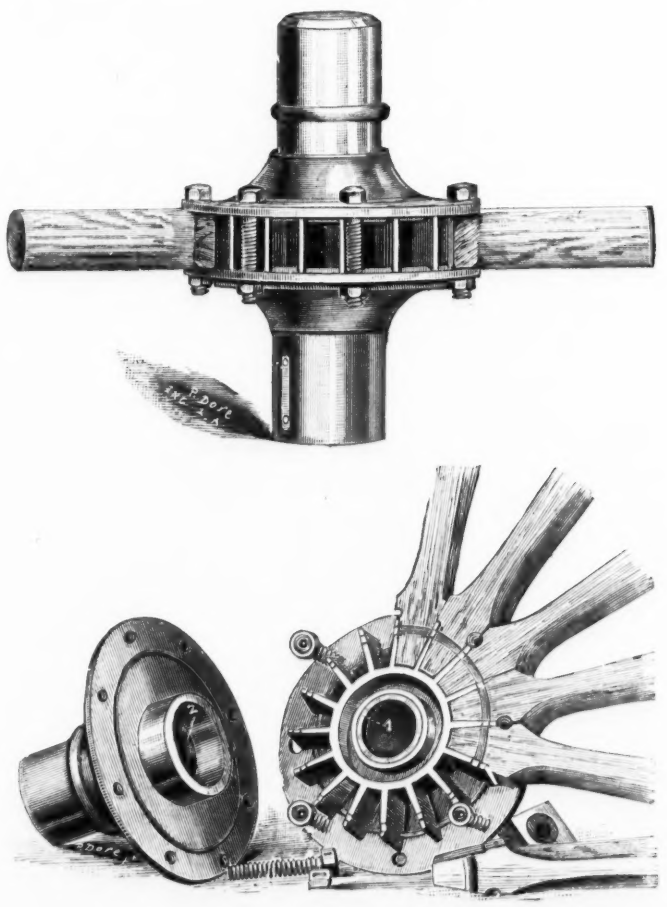
The commendable efforts of Mr. Leicester Allen to stimulate the cultivation of inventive capacity have no doubt had a beneficial effect in causing many to engage in solving the interesting problems that would probably have spent the time in a less profitable way had they not been proposed.

There is another direction of equal importance in which the same faculties employed in the solution of the problems may be profitably cultivated, and which will add considerable to their scope, that is the practice of observation and investigation.

Although for a person to keep apace especially with mechanical progress, the practice of observation and investigation is of the utmost importance, as thereby the experience of others is acquired. It is somewhat surprising to note to what small extent it prevails amongst mechanics. Men may have used simple devices for years, and yet be ignorant of their principles of operation, simply from a habit of not closely observing and investigating familiar things.

I was led to these reflections by a case in point a short time since.

In a large government establishment where



THE "CALIFORNIA" WHEEL.

are employed many of the best and most intelligent mechanics, and where that useful device, the differential chain hoist, is extensively employed, a discussion arose regarding its principle of operation. Many of

those familiar with the use of the instrument were unable to explain its principle of operation. On being appealed to, I offered an explanation substantially as follows:

To facilitate following the meandering of the endless chain, which is somewhat confusing when both sprocket wheels are cast together, as in the usual form, the wheels are represented separated and geared together with wheels of an equal number of teeth, as they will in this case revolve in equal times; the result in operation is evidently the same as if they both revolved about the same axis.

Let the wheel *a* be 25 inches in circumference, and the wheel *b* 24 inches, and contain respectively the above number of sprockets. Then, if a force be applied as illustrated, and the wheels make one revolution, the force will descend 25 inches. It will be observed that all parts of the chain have not the same movement, the portion passing around the pulley *c* will ascend 25 inches on one side, and descend 24 inches on the other. Hence the weight suspended from the pulley will be lifted one-half the difference, or

$$\frac{25-24}{2} = .5 \text{ inch.}$$

Now to obtain equilibrium in systems of this character eliminating internal resistances, the product of the weight and its velocity must equal the product of the force and its velocity.

Let it be required to find what amount of force would be required to balance a weight of 5,000 pounds. It will equal

$$\frac{5{,}000 \times .5}{25} = 100 \text{ pounds.}$$

The usual construction is to make one wheel one sprocket less than the other. If both wheels contained the same number of sprockets, the device could not lift at all, as all parts of the chain would then have the same velocity in operation.

It might cursorily be inferred from this fact that the device would possess greater lifting power with a reduced number of sprockets in one wheel. Investigation, however, would prove this not to be the case.

Suppose the wheel *b* of 24 sprockets be reduced to 19, the other, *a*, retaining 25 sprockets. The chain, then, in passing around pulley *c* would ascend 25 and descend 19 inches, and the weight would be lifted

$$\frac{25-19}{2} = 3 \text{ inches.}$$

Hence the force necessary to balance the 5,000 pounds will equal

$$\frac{5{,}000 \times 3}{25} = 600 \text{ pounds.}$$

The "California" Wheel.

The vehicle wheel shown with this is the invention of Wells H. White, of Los Angeles, Cal. As will be seen, the hub, in which is the essential difference between this and ordinary wheels for a similar purpose, is made of two pieces that are held together by bolts and by suitable tongues and grooves. In being drawn together these pieces embrace the spokes, which are thus rigidly secured in suitable recesses, as clearly shown in the engravings. The hubs are suitably recessed and filled with babbitt metal to fit the axle. The wheel being in place on the axle, a cap is screwed over the end, covering the nut and excluding dust.

The parts of the hub are made of malleable iron or any alloy that may be preferred, and can, of course, be plated and kept up to any degree of finish. As, for example, the outer front part of the hub can be quickly removed for replating, leaving the rest of the wheel intact.

A wheel made in this way posesses many valuable features, it would seem, over those of ordinary make, and it is claimed that it is no heavier than an ordinary wheel properly ironed. It will be seen that the spoke is kept of full strength where it enters the hub, and that in case of the accidental breaking of one or more spokes it is necessary only to remove the front part of the hub and substitute new ones—a very short job. It is equally evident that the two parts of the hub can be drawn closer together by the bolts should the spokes shrink. Should the fit become loose on the axle, the simple operation of re babbitting will restore the fit. Any or all of the three pieces (including the cap as one piece) of which the hub is composed may be kept in duplicate, making repairs a very simple operation. To oil the wheel it is not necessary to remove it—it is oiled the same as a loose pulley or any analogous part of a machine.

These wheels are made of size or strength for all classes of vehicles, from the lightest to the heaviest, and of any degree of finish desired.

There is nothing new in those who have to edit correspondence in a newspaper office utilizing the columns of the paper for the purpose of making the rather reasonable request that correspondents sign their names legibly. The incentive to do so is always present and so is the paper. When we make this request now, it is only from a sense of duty to help in keeping it before writers for the press. After a reader of manuscript—which appears to be right in all other respects—has spent about an hour in an unremunerative effort to make something reasonable out of a signature that none or all the letters of the alphabet will fit, he is very likely to give the printer entire liberty in the matter, who is sure to make something of it without serious delay in getting the type in position. The name, as it eventually appears, may not be just the one that the writer is proud to claim, but it is something that stands for a name.

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J. G. A. MEYER, } Associates.
FRED J. MILLER, }

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☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

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NEW YORK, JULY 13, 1893.

CONTENTS.

	PAGE.
Double Crank Power Press	1
Explosion of the Feed Pipe Casing on the "Great Eastern." By W. F. Durfee	1, 2
Columbian Exhibition Notes. By F. J. M.	3, 4
Why Do Brass Pipes Crack? By Peter H Bullock	4, 5
Hydraulic Riveting Machines	5
"Star" Head Blocks	5
Combined Sawing, Boring and Chamfering Machine for Wagon and Carriage Makers	5
Letters from Practical Men: Mud Drum Valves—How the Cylinder Was Broken. By S. A. Smith ... Height Gauge. By C. A. Burton ... Gear Teeth. By George B. Grant ... Dynamos. By Sand. Master Mechanics Committee on Fire-box Steel. By Wm. Kent ... Says it is a German, not an Austrian Exhibit. By Henry C. Dubbel ... A Device for Holding Chaplets. By Geo. A. Webster	5, 6, 7
The Differential Chain Hoist. By I. McKim Chase	7
The "California" Wheel	7
Headquarters at the Fair	8
It Was Surprising, if That is the Word	8
The Potent Concessionnaire at Chicago	8
Questions and Answers	9
Things to See at the Fair	9, 10
Keys. By W. H. Booth	10
Manufactures	11, 12
Machinists' Supplies and Iron	12

Headquarters at the Fair.

During the continuance of the Chicago Exposition the AMERICAN MACHINIST will have its headquarters in the space allotted to the Mechanical Press in Machinery Hall. The exact location is Section No. 27, Column K 37. Word can be left with the attendant there by any one who is desirous of meeting a representative of this paper, who may at the time be engaged elsewhere on the grounds.

It Was Surprising, if That is the Word.

The Master Mechanics' Association as a body is one the opinion of which ought to carry a good deal of weight, composed as it is of men holding responsible positions, and who, for the most part, have gone up the ladder from the lower rounds and know by experience of the questions they discuss and take action upon.

It is a body whose members are supposed to weigh their conclusions with a good deal of care, express them with a good deal of force and stand by them tenaciously.

This makes their action at the recent convention on the question of the use of water glasses on locomotives all the more remarkable. The committee, touching this matter, offered to the convention the following conclusion:

3d. Water gauge glasses are not a necessity, while same may be a convenience to engineers and firemen, and that when same are used they should be applied with automatic closing valves.

Against this many members spoke quite vehemently. It was a good deal more than probable that there were few that would vote with the committee on this until Mr. Clark gave the matter quite a different turn by speaking as follows:

I do not think this association should put itself on record that it is absolutely necessary to have a water glass put on a locomotive. I attended a lawsuit recently in Buffalo where an engine had exploded, killing the engineer and fireman. The case was that there was no water glass and no fusible plug in the fire box. A number of master mechanics were there from different roads to testify, and it was finally decided that the water glasses were not necessary. If we put ourself on record that the water glass is absolutely necessary there will be some suits based upon that.

This settled the matter. The prospective vision of some fireman's widow and orphans beating a railroad company that was too penurious to buy water glasses out of five thousand dollars was too radical a thing in its way for the master mechanics, who rather suddenly became remarkably conservative, to view with anything short of consternation, necessity or no necessity.

It is true Mr. Lewis "would very much dislike to have this association take the stand that the water glass is not necessary," and Mr. Sprague spoke most sensibly and earnestly as follows:

I would like to say one word in regard to the legal aspect of the thing. It has raised in my mind the question whether we are here to give our best judgment as to what is proper and safe for locomotive practice, or whether we are here to evade legal obligations—whether we are here to advance the interests of the locomotive or whether we are here to whip the devil around a stump and avoid lawsuits. I do not think that ought to be taken into consideration. If we are satisfied that a thing is an advantage to the locomotive, we ought to advocate it regardless of lawsuits.

But Mr. Setchel's resolution as below prevailed, we believe without a dissenting voice:

Resolved, That while the Master Mechanics' Association regard the water glass as a convenience and an additional precaution against low water we do not regard it as an absolute necessity to the safe running of locomotives.

There is abundant room for comment on the foregoing, but the story is better just as it was told; it is a case in which comment would be superfluous; altogether superfluous.

If it is true, as has been reported, that a good many thousand rounds of ammunition were sent out in readiness for use when it was feared that the iron manufacturers and their workmen would not be able to agree upon a scale for the ensuing year, it is discouraging to those who realize that peace between employers and employes must eventually be maintained, if maintained at all, by other means than by military force. It may have been a wise precaution to prepare to keep peace by force of arms, but the fact—if it is a fact—that such precautions were necessary is not re assuring; it is evidence that something is wrong that good, sound common sense should be able to set right. If a man has his labor to sell there is no reason in the world why he should not get the best price he can for it through the employment of any peaceful and honorable means to that end. On the other hand, there is no reason why a man who is paying for labor shall pay more than is equitable. If there are laws that stand in the way, in either case they should be remedied by means of the ballot, which, when properly used, is a remarkably effective weapon.

The Potent Concessionnaire at Chicago.

It would seem as though one of the lessons to be learned from experience with the present exhibition at Chicago, is to the effect that it is possible to go too far in granting exclusive privileges and rights to concessionnaires, *i. e.*, those who, for a stated sum or in consideration of the payment of a percentage of receipts, secure the exclusive right to do certain things, to render certain services or to sell certain articles within the grounds. The amounts which the management of an exhibition can secure from these concessionnaires are a very large proportion of the total revenues, and are naturally very tempting to the management, which may be in much doubt as to the financial outcome of the undertaking. But we think experience at Chicago is showing that it may be possible by giving concessionnaires too much power and authority, to reap from them at the expense of the gate receipts and the general reputation of the undertaking.

The medical men connected with the Fair have stated that 90 per cent. of the cases brought for treatment to the hospitals on the grounds are cases of physical exhaustion caused by over exertion. They have recommended as a remedy for this that more seats be provided within the grounds, but it is charged that the men who control the chair concession and have chairs to rent fear that their business may be interfered with if there are an abundance of seats as there should be, and that their influence is potent in restricting the number of free seats.

In the matter of photographs, things are carried with rather a high hand. We understand that in this case, the official photographer does not own the concession in the same sense that other concessionnaires own theirs, but that he has the exclusive right to take photographs, and is paid a salary in addition to a percentage of the receipts. Be this as it may, he seems to have absolute control of the matter, and in one case actually took away from the representative of a publisher his permit to take some certain photographs within the grounds—a permit which had been issued by and bore the autograph of Director General Davis, and was as much the private property of the man from whom it was taken as was his money or any other of his belongings. We happen to know of the representative of a very prominent industrial establishment which has a number of engines running at the Fair, who had one of them photographed and paid for the service in advance, as is required in every case. When the photograph was delivered, there was so much distortion in it as to make it look as though a universal coupling was needed between the crank-shaft and the armature shaft, though the two were actually in line. Upon complaining of this, the machinery man was gruffly informed that if that did not suit him he had "better make his own photographs." He replied that he would be very glad to make them if allowed to do so, but very soon found that the advice to make his own photographs was merely ironical, and that he would not be allowed to make them—as he happened to be abundantly competent to do.

There is very much complaint also of the manner in which the matter of lavatories and retiring rooms is managed, the officials of the Fair admitting that there are abuses connected with this which they charge to the concessionnaire and promise to see righted. Under the present arrangement, while it is supposed that there are closets which are free to the public, as a matter of fact and practically one must pay a tax of from ten to twenty cents per day on this score; the only way of avoiding this being either by long walks and sacrifice of time or some sacrifice of decency and comfort.

The conclusion seems to be that the greed of concessionnaires should not be quite so potent a factor in regulating these matters, but that some authority interested in the success of the Fair and intelligent enough to recognize the importance of making visitors reasonably comfortable and well satisfied, should have supervision of all concessions. If this were done, probably the catering company which runs the lunch counter in Machinery Hall would not so long continue to disgust every one who patronizes it, and the requisitions of the man who has immediate charge of it calling for such articles as civilized people are in the habit of using at meals would receive some attention from the owners of the concession.

The country may never know the real magnitude of the debt it owes the few New York bankers who, when the rate of interest on loans had risen far above all reason, threw upon the market $6,000,000, accompanied with the assurance that more would be promptly forthcoming if it were needed to supply the legitimate demands of merchants in need of funds with which to carry on business, and at reasonable rates. By this action the rate of interest was forced down to 6 per cent., and those who had been doing their best to bring on a panic and widespread financial disaster by spreading reports calculated to diminish confidence were defeated.

There are well authenticated reports that these last-mentioned parties in some instances actually paid by their own checks the interest on loans which they had bid for at absurdly high rates, but which they did not actually take at all, the object being, of course, to create the impression that money was so scarce and we were so near a general crash and upsetting of values that nothing but the actual possession of cash offered any security worth considering. Of course, this was done for the purpose of effecting gambling operations of some kind, and there is talk of punishment for it by the exchanges. It is a pity that there is no prospect of punishment by the sheriff.

There will be more than the usual quantity of "summer vacations" amongst workmen in shops and factories this summer and fall. More than the usual "shut-downs" will occur to give the men a chance to see the Fair, influenced perhaps to some extent by other considerations. In this connection we feel constrained to call attention to the fact that just now is a good time to apply some of the "small things" in steam engineering to which we recently referred. There are hundreds of steam plants that ought to have a good many appliances that they now lack, and if their satisfactory application requires a day, or a few days of idleness, it is a good year and a good time of the year for it. Summer vacations—a few days away from work—are becoming more and more common, and there is a rather natural connection between them and rehabilitating steam plants. This year the connection ought to be more than usually apparent.

Anthracite coal advanced the 1st of July twenty-five cents a ton. Our coal barons do not allow the people to go to the mines for coal, and then waylay and rob them as

they carry it away. That would be the old, crude and obsolete way of doing it. It is much safer to hire shrewd lawyers and then just meet in elegant offices and "agree" that prices ought to advance, which, of course, they immediately do, the other interested parties having apparently nothing to do with the matter except to pay the price demanded.

Questions and Answers.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(334) C. P., Hartford, Conn., asks: Do you think it would be practical to pump air through a red-hot pipe into the boiler and supply the engine with half air and half steam? *A.*—No.

(335) X. Y., Fitchburg, Mass., writes: Please inform me which books treating on algebra, geometry, and trigonometry are suitable for self-instruction. *A.*—See page 4 in our issue of February 19, 1891.

(336) J. A. S., Pittsburgh, Pa., writes: Kindly inform me of the size of a fly wheel for a $\frac{1}{16}$ horse-power engine. *A.*—We should make it 8 inches in diameter, weighing about 15 pounds. 2. Will a governor be required on such a small engine? *A.*—No.

(337) J., Johnstown, Pa., writes: Please give me the names of three or four books treating on electricity in a practical way. *A.*—Alternating Currents of Electricity, by Gisbert Knapp, C. E.; Modern Practice of the Electric Telegraph, by F. L. Pope; The Elements of Dynamic Electricity and Magnetism, by P. Atkinson, A. M., Ph. D.

(338) H. T. W., Brooklyn, N. Y., writes: You will greatly oblige me by informing me what kind of preparation some firemen use to whiten their fire doors where ordinary boiler paints would soon burn off. *A.*—We believe that a graphite or an asbestos paint will answer your purpose.

(339) E. J., Dayton, Ohio, asks: Are there any trade schools where the practical work of the machinists' trade can be learned to an extent such as to enable a person, after he has taken a course, to follow up the trade in any shop? *A.*—There are trade schools which will give a person a fair start as an apprentice. The best school is the machine shop.

(340) L. J. F., Ausable Forks, N. Y., writes: Instead of building a conductor 6 inches in diameter as stated in my Question 196, in your issue of April 30, I intend to build one 6 feet in diameter, and I have also abandoned wood for its construction, and will build it of iron. What should be done to prevent freezing? *A.*—Cover it well with asbestos, and, if possible, keep in it a current during cold weather.

(341) W. C. R., Chicago, Ill., writes: I shall be very thankful if you will give me a drawing to scale and description of a drill press consisting of two upright steel bars, and two cross-bars to hold the drill spindle. The drill press must be strong enough to bore holes 1 inch in diameter. *A.*—We should be pleased to comply with your request if we had such a drawing on hand; but not having one we must advise you to engage an engineer competent to make the design for you. We have no time to design special machines.

(342) J. H., Brooklyn, N. Y., writes: Kindly inform me of a good practical book treating on stationary engines, and containing numerous illustrations of different types. *A.*—"Descriptive Treatise on Constructive Steam Engineering," embracing engines, pumps, and boilers, by J. M. Whitham, contains numerous illustrations of stationary engines; but since we do not know for what particular purpose you wish to use it, we do not know whether it will suit you or not. It is a useful book, but also a high-priced one—we should therefore advise you to examine it before you buy it.

(343) L. A., Baltimore, Md., writes: Please inform me what kind of steel is used for corrugating flour mill rollers, and how the tools should be tempered? *A.*—Any good quality of tool steel should answer your purpose; but to avoid all disappointments we should advise you to order the steel of a reliable firm, and state in your order the purpose for which the steel is to be used. For hardening the tool experience is required. It should be heated up to the hardening heat, which depends on the grade of the tool steel used. It is important to secure an even heat not only when the tool is ready for plunging, but it should be kept even during the entire process of heating. When at the proper heat dip the tool straight into the water without lateral motion. After this draw the temper. 2. Please give the best way of annealing copper. *A.*—Heat it and cool it quickly in water.

(344) J. D., Philadelphia, Pa., writes: Please inform me what the diameter of a pipe 6 feet long should be, which when filled with coal oil will give a pressure of 2 pounds at the bottom. *A.*—The weight of a column of petroleum (or coal oil, as it is sometimes called) 1 foot high and 1 inch square will weigh .381 of a pound; a column 6 feet high will weigh $6 \times .381 = 2.286$ pounds; hence, for a pressure of 2 pounds at the bottom, a cross-sectional area of $\frac{2}{2.28} = .877$ square inch will be required; the corresponding diameter is $1\frac{1}{16}$ inches very nearly; this, of course, is the diameter of the pipe.

(345) C. M. H., ——, Ind., asks: Is there a good book on mechanical drawing published, treating principally on machine shop practice, and which does not dwell much on marine or locomotive work? *A.*—Mechanical Drawing, by C. W. MacCord, A. M., Sc. D., published by John Wiley & Sons, may suit you. Machine Drawing and Design for technical schools and engineer students, by Prof. Wm. Ripper, is another good work. But it should be remembered that the principles of mechanical drawing do not change, no matter whether the drawing represents a locomotive, marine engine, or any other machine or structure; hence the underlying principles of mechanical drawing can be learned as effectually from any good book treating on mechanical drawing. The articles on practical drawing, published in the AMERICAN MACHINIST, explain the principles of mechanical drawing.

(346) Y. M., Greensburg, Pa., writes: A young man 17 years of age having a fair common school education, and one year of experience with machinery and now in a tool room, desires to take a course of study in mechanics, particularly in the line of electrical engineering. He can raise means enough now to give him a start, but not enough to carry him through a full course. Are there not some trade schools in the country where he could help himself along by working a part of the time in the machine shop? Please advise what course would be the wisest to pursue. *A.*—We should advise him to obtain employment in a shop where machines for electrical purposes are made; study at home in his leisure hours, and save his money, so that, if possible, he can take a full course in a college. There are a few trade schools, and if such a one is near his place of employment he can easily find out upon what terms he can enter it; or write to any of the technical institutions mentioned in our answer to Question 239 in our issue of June 2, 1892, so as to enable him to decide on a course to achieve the desired end.

(347) J. O. B., New Orleans, La., writes: Kindly inform me where I could get a book treating on engine foundations. I have seen a number of them and can find no information whatever on the subject. Or can you give me a formula, that is, how much weight is required to absorb vibration? The inclosed sketch shows a foundation which does very well for a speed of 120 revolutions, but vibrates $\frac{1}{16}$ inch at floor line when the engine is running at the rate of 200 revolutions. I allow about 100 cubic feet of brick in foundation, which, if taken at 100 pounds per cubic foot, would give 10,000 pounds. The engine has one cylinder 8x10 inches. I have put up a great deal of machinery but the foundations have always been a source of worry to me. I have so far guessed the weight pretty well, but this is not proper. There ought to be a way to get at it approximately. *A.*—We have not been able to find a work that treats on engine foundations. Even eminent authors treating on the steam engine, as far as we have seen, give no information of any practical value on this subject It is difficult to establish a formula that will give satisfactory results in all cases, as the nature of the soil or rock upon which a foundation is to rest, the type of engine, and the weight of the engine itself will determine the character of the foundation and the dimensions to be given in any particular case. The best way is to procure from the builder of an engine a plan of its foundation, as his experience and his interest in the successful working of the engine qualify him better than any one else to give the correct dimensions of the foundation, one that is economical in material and that will meet all the requirements of the engine.

(348) S. S. M., Waukegan, Ill., writes: Please give the solution of the following and show the manner of working it. A horizontal oil tank has leaked, so that the surface of the oil is 15 inches below the top of tank. The tank is 6 feet diameter and 19 feet 11 inches long. What quantity has been lost in gallons? *A.*—In this case we shall have to compute the area of the segment of a circle 72 inches diameter, the height of the segment being 15 inches. Subtracting 15 inches from 72 inches we have a remainder of 57 inches. One-half the chord of this segment is equal to $\sqrt{57 \times 15} = 29.24$ inches. The sine of one-half of the angle formed by the radii drawn to extremities of chord is equal to $\frac{29.24}{36} = .8122$. Looking in a table of natural sines for this number we find that this angle contains 54 degrees and 19 minutes, consequently the whole angle formed by the radii drawn to extremities of the chord will contain $54.19 \times 2 = 108°,38'$. From this data we obtain the area of the corresponding sector as follows: The whole area of the circle, 72 inches in diameter, is 4,071.5 square inches, and the area of the sector will be

$$\frac{4,071.5 \times 108°.31'}{360} = 1,228.64$$

square inches. From this subtract the area of the triangle formed by the radii drawn to the extremities of the chord, and the chord. This area is equal to $29.24 \times 21 = 614.04$ square inches, and $1,228\,64 - 614.04 = 614.6$ square inches for the area of the segment. Multiplying this by the length of the tank in inches we have

$$614\,6 \times 239 = 146,889.4$$

cubic inches for the volume of oil that has leaked out. There are 231 cubic inches in the gallon, hence the number of gallons lost by leakage will be $\frac{146,889.4}{231} = 635.8$ gallons. In these computations we have taken no account of the slight curvature of the heads as shown in your sketch. In this case the area of the segment has been computed by the rules given in answer to Question 221 in our issue of May 4, current volume. Compare the two.

(349) F. W. B., Hamilton, ——, writes: I am a young man 26 years of age, I left school at 15 years, served as an entry clerk in a wholesale house for 3 years, but finding it did not agree with me, took to farming, at which I spent $4\frac{1}{2}$ years, and found it greatly improved my health. Not caring for this occupation, and having a great fancy for machinery, I decided to make a change, and procured a position as apprentice in an engine manufacturing establishment. I am pleased to say that I have struck the very thing I like most, and therefore have decided to stay with it for good, and make a success of it, if possible. I have now been at it $3\frac{1}{2}$ years ($1\frac{1}{2}$ years in the shop and 2 years in the drawing room). I am entirely dependent upon myself. I cannot say that I have more than an ordinary education. I am ambitious to succeed in this business and become thoroughly proficient, and to be a first class draftsman. I have the opportunity of working in the shop and the drawing office, but there is not sufficient work to keep me permanently engaged in the office, hence the change from office to shop. Would you advise me to remain in the present position, or to go to some school of science? For young men in similar positions what school offers the best and cheapest inducements? And is it really necessary to go to such a school? *A.*—It is not absolutely necessary to go through a course of engineering in a technical institution, but it is better to do so, as the progress in the studies will be much faster and pleasanter than by studying at home. We do not know anything of the shop in which you are engaged, and as your progress depends much on the kind of work you have to do, and the qualifications of the men in the shop with which you have to associate, we are not in a position to give you the best advice. However, from your letter we should judge that you have a good opportunity to learn the practical part of the engineering profession which is just as necessary as a theoretical training. We loath to advise you to leave a good position, and perhaps throw away an opportunity which you may not be able to secure again, without great difficulty. Since you must have a comparatively good education to pass the examination for the admittance into a technical institution, the best course for you to pursue will probably be to hold on to the position you have got, and study in the evenings, following the course of study as indicated in our issue of February 19, 1891. This will, in a short time, enable you to judge whether you should go to a technical institution or not. In answer to Question 239 in our issue of June 2, 1892, we have given the names of a few technical schools; for any person who is determined to learn, one is as good as the other. As for cheapness write to all of them for their terms and make your own selection. 2 What is the best way of taking care of mechanics' fine tools so as to prevent them from rusting? And what is the proper thing to use for polishing them? *A.*—Wipe them dry and give them a light coat of paraffine. For polishing use flour of emery.

Business Specials

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

A Book Free. See page 12.

Shafting Straighteners J. H. Wells, Tampa, Fla.

Ideal Drawing Stands. M. C. Hammett, Troy, N.Y.

Forming Lathes Mer. Mach. Tool Co., Meriden, Ct.

Air Hoists, Frank Richards, Box 3686, N. Y.

Milling Machs. Kempsmith M. T. Co., Mil., Wis.

Agents Wanted—Scientific Machinist, Clev'd, O.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

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Drill Presses, with Tapping Attachments.
Gould & Eberhardt, Newark, N. J.

Davis Key Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty St, N. Y.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N.Y.

Pulley lathes, most efficient offered. The Lodge & Shipley Machine Tool Co., Cincinnati, O.

For Cypress Tanks and Vats, address W. E. Caldwell Co., Floyd and Main Streets, Louisville, Ky.

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G. T. McLauthlin & Co., Fulton Street, Boston.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

"Shapers (Double Triple Quick Stroke")
Trade Mark.
Gould & Eberhardt, Newark, N. J.

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12-inch breech-loading rifled mortar & mounting, w'ght 118,000 lbs, front Gov't B'ld'g, World's Fair; des'n on applica'n. Builders Iron F'dry, Prov., R. I.

Gear Cutters, Auto. Specially adapted for Motor Gears and all other style Gears.
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Something new in name plates; "oxidized aluminum"; write for sample. Finest castings in the world, made by patent pressure process. Passaic Art Casting Co, 35 Warren St., New York.

Patent Soliciting of High Class.
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De Lamater Screw Propeller Wheel, made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

"Binders" for the AMERICAN MACHINIST. Two styles the "Common Sense," as heretofore sold by us and mailed to any address at $1 00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUBLISHING CO., 203 Broadway, New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

Things to See at the Fair—Continued.

FRIEND HEMENWAY: Leaving the Mining Building at the south end, one is in a position to get one of the finest building views to be seen in this country, and perhaps the finest any one now living is likely to get in America. Take it as a picture—a picture in plaster of Paris, if you will, and it's grand. The Administration Building and Machinery Hall in front, Electricity Building on the immediate left, the Manufacturers' Building beyond, with the peristyle joining it with the Music Hall and Casino, and the Agricultural Building in the distance, all surrounding a small lake or lagoon, and it makes a sight to be remembered.

Continuing the tramp through the buildings, we found the Electricity Building (which might as well have been a part of the machinery exhibit) the furthest from being in showable shape of any. The great central tower of light had not been opened out to view, and squares upon squares were in confusion. One show-piece was running, and though not free from criticism according to my mind, it was a surprise and a delight. A column of incandescent lights, in colored globes, from its top there run out in four diagonal directions, what looked like troughs of lights, not going directly straight, but in a zig-zag way, something like a rail fence, and each of these terminated in a ball of colored lights, always rotating on its vertical center.

How these lights are operated is of no consequence, but how they look is this way: Imagine the light to start at the bottom of

a column and travel up in a spiral path, as one would himself travel up a spiral stairway, the light constantly changing from white to red, yellow and blue, and as it reaches the top to divide into the four troughs, run out like water taking all the colors as it goes, and entering the balls, which keep going, are colored alternately red, yellow or purple, and then die out, as if the light had run out of them, and down to the bottom of the column, when it again appears for its upward spiral course.

I could not divest myself of the idea that the light was actually a liquid, something running along like water. Beautiful and fascinating as the thing was—and I went every day to see it—the point to criticise is this; it was mechanical in its get up, and not artistic. It was a thing of beauty, and made for nothing else, and why, when we have those things to do, do we not get an artist instead of a mechanic to design them? I do not mean to invent and devise, but to design, to give it the artistic twist.

Certainly no artist would have adopted the rail fence diverging course, nor had them all alike. The electricians are the worst of us all. Ohms and amperes, volts and watts and potentials, resistances, conductivity, rheostats, pressure, cut outs and switches, seem to have switched out, cut out, or short circuited their entire artistic instinct. Before one of the recent Westinghouse dynamos was brought out, good designing and electricity do not seem to have got acquainted with one another.

I can readily imagine by the time you get to Chicago there will be a world of interesting and nice things in the Electrical Building to see, and there is even now too much for me to show my ignorance about, though just why the power plant should be in Machinery Hall, and the electricity by itself, I don't see. Until the electricity is obtained direct from the coil, it will be hard to divorce it from the power house whether the steam engine or water power is the prime mover. Leaving the Electricity Building, which is next to and duplicate in size to the Mining Building, and a general idea of which may be obtained by three trips up and down its three main aisles, cross over to Machinery Hall by way of the Administration Building. Go inside and try and imagine you are under the dome of St. Paul's or the Pantheon at Paris; over the tomb of Napoleon; under the dome of the Invalides; in St. Mark's, at Venice; in the Cathedral at Florence, or the Pantheon or St. Peter's at Rome. If you can fancy either you can make believe awful. No, it's big, it's lofty; it tries to be good, but cannot. It's cool, and a good place to rest, and everybody wishes the sixteen seats were sixteen hundred

Machinery Hall, as a building to look at, is about as good as any, perhaps the best, but a machine designer could never indulge in such expensive additions for looks. All along each side and all along the front, both where it is to be seen (and where never seen except by passengers on the intramural or overhead railroad) there are extensive and expensive second story verandas, with fine colonnades. These covered balconies, large enough to hold ten thousand people, would be comfortable places the right time of day to sit down in and take comfort, but no one is to go there—no one has time to take comfort, and there are no seats or lounges or hammocks there if he had. Thousands of dollars for architectural effect, and so far a success—much more so than thousands of other dollars spent for a half dozen spires which are not architectural successes.

The pediment design of sculptured work over the main entrance, I fancy the most meritorious of all the statuary decorations on the buildings, is just where very few will ever see it. The lagoon is too near and the Agricultural Building pretty far away to get a good view.

The building with its annex is about the size of Machinery Hall at the Centennial, which, if I remember correctly, was 600 feet wide by 1,400 long. It is more lofty and the trusses are of iron, but with the Corliss engine left out it does not, some way, look so very imposing. Likely there was never before so much power assembled in so small a space as is gathered together in the one-sixth of this building, certainly never such a variety of engines. Forty engines from half as many builders, twenty or thirty thousand horse power in all—in sizes from two to two thousand. The great stride in engine construction since the Centennial is the jump from single to compound, triple and quadruple cylinder expansion, and the obtaining of much larger power from the same material and money—better governing and better workmanship. Among the novelties that I noticed are the methods of getting Corliss results by new means. The Bates and the California engines, by new mechanism, the Atlas and the Payne, by new methods and new mechanism and the Reynolds new attachment to give a better cut-off to the Corliss motion, an important thing in the multi-cylinder expansion, because theoriginalCorliss does not give a cut off much later than about the point where the multiple cylinder works at its best and hence the plain Corliss gear does not give much margin of reserve power.

Probably there are other novelties of detail such as a new form of the old inertia idea in governing, about which every new man feels bound to have a whack at, and the Westinghouse balancing device for the valve motion nicely worked out.

It is not safe to predict much about the success or non success of anything about this Exposition, but I cannot see how the traveling crane people are to harvest such a crop as was done by the originators of the idea at Paris.

There one taking a trip on the crane had a view of the whole machine exhibit, whereas here he only gets it in thirds. There one was helped up by the elevator, and here it seems he must mount the out of-the-way stairs. I certainly shall be surprised to learn of crowds waiting their turn.

But, isn't the place hot on a hot day? If ventilation does not come pretty soon evacuation will. The exhibitors won't stand it.

JOHN E. SWEET.

Keys.

BY W. H. BOOTH.

Keys are subjected to two species of stress according to the manner in which they are fitted. If a wheel be made to fit a shaft closely a key is put in to prevent the wheel turning upon the shaft. For this purpose a groove is cut in both shaft and wheel and a rectangular key fitted more or less tightly sideways. If it also fits tightly at the top and bottom it will cause the wheel and shaft to grip partially by friction, and this will somewhat reduce the lateral working stress in the key. A key of this description owes its strength to its length and breadth, for it is exposed to a shearing stress and may give way by being cut in two, one half filling up the groove in the wheel, and the other remaining in the shaft. The area of the key on the sheared section is, of course, length $\times$ breadth and in a key one inch broad and six inches long the resistance of the key will be $6 \times 1 \times 7{,}500$, the latter being an assumed coefficient of shearing resistance. This absolute strength of key probably enters very little into the question of proper practical dimensions. It tells us, however, that for the case of a wheel and pinion working together, as the tooth pressure is the same on both, the stress in the pinion key must be much less than the stress in the wheel key unless the two shafts have diameters proportionate to their respective wheels.

Where a wheel is fixed by a key simply bedded upon a flat place upon the shaft there can be no question of shearing, but the resistance of the key to compression comes into play and prevents the key being so crushed as to allow the wheel to revolve without the shaft.

This is the method of keying large and heavy wheels and is perfectly satisfactory. The principles brought into action point to the advantage being in favor of thin keys which can be crushed both relatively and absolutely less than thick keys, but there is a limit to thinness, a thin key not being capable of standing up against the driving necessary in fitting and final fixing. When a wheel is bored a fit on a shaft the circular key driven into a hole drilled equally in both shaft and hub is well-known, and it has an area of shearing resistance equal to its length multiplied by its diameter. Such keys are often found in English marine work holding crosshead pins in place against a tendency to revolve, and in heavy work when the key is itself large it is held in turn by another and smaller key, the latter being threaded and screwed in tight.

To insure provision against actual stress apart from other considerations the shear in

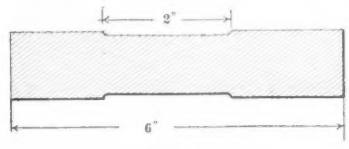


Fig. 1.

a key is very easily deduced from a knowledge of the power to be transmitted.

Let us suppose 1,000 horse-power to be taken off a rope rim running at 5,000 feet per minute velocity. The pull at the rim is $33{,}000 \times 1{,}000 \div 5{,}000 = 6{,}600$ pounds; the radius being, we will say, 15 feet and the shaft having a diameter of 24 inches at the key swell we have a shearing stress of $6{,}600 \times 15 = 99{,}000$ pounds. Taking 6,000 pounds per inch area as a suitable working stress would give $16\frac{1}{2}$ inches of key area, so that with a single key having two bearings in a recessed boss each 6 inches long the breadth would be only $1\frac{1}{2}$ inches at the outside, but we may doubt if a stress of 6,000 pounds could be carried by a key very long without it becoming battered.

But there is another consideration. The

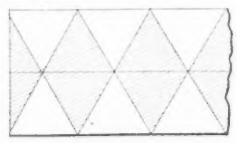


Fig. 2

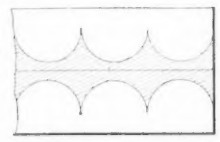


Fig. 3

depth of the key-bed in the shaft will only be, we will say, $\frac{1}{4}$ inch at the sides of the key, and the available length in a key only $1\frac{1}{2}$ inches wide cannot be greater than the length of the two key-beds in the recessed boss, namely 12 inches.

The area of the key side through which the 99,000 pounds has to be transmitted is thus only 3 square inches or $12 \times \frac{1}{4}$, and the bearing stress is therefore 33,000 pounds per inch. This is three times a safe bearing pressure, and on the principle of absolute strength alone we should want three such keys for our wheel unless we are prepared to cut deep key ways into the shaft. Thus it is that for large wheels the key-ways are simply flats on the shaft, and four or eight keys are fitted and injury to the shaft by incutting avoided. With a key, say 6 inches wide, let us assume all the fitting to come on the edges over a breadth of half an inch. Then the stress of 99,000 at one foot radius transferred to a key whose average half breadth at the bearing or fitted surface is $\frac{3 + 2\frac{1}{2}}{2} = 2\frac{3}{4}$ inches will be $99{,}000 \times 2\frac{3}{4} = 272{,}250$ pounds. Still adhering to our original 12 inches of bearing length we get $12 \times \frac{1}{2} = 6$ square inches to bear the pressure of 272,250 pounds, being 45,375 pounds per square inch, and though this seems heavy it occurs upon a key perhaps $1\frac{1}{2}$ inch deep only which cannot get away from the pressure. It is too shallow to cripple like a column and too much supported by the general body of the key to flow away. The addition of other keys will not serve to reduce the stress in any way in the instance of keys which act by resistance to crushing, but each key will take the same pressure.

Fig. 4

I am now coming to what I wanted to say, though it has taken me a long time to get there, and that is that it is bad in principle as well as in practice to fit a key over its whole breadth. The exact center of a key cannot possibly exert any resistance against the wheel moving round on the shaft, for it is merely like a knife-edge bearing. It is only by possessing breadth that such a key can act, its edges or parts furthest away from the longitudinal center line having the largest lever arm, and though I would not in practice confine the fitting on a 6-inch wide key along a half inch strip each side, I would remove a considerable breadth of the middle of the key as in Fig. 1 where a key is shown in cross-section with the middle eased off so as not to fit. When a key is fitted on its whole breadth the tendency is for rock to occur. The work passing through the wheel cannot act to compress the key along its center line. The greatest pressure comes on the edges and these compress, and the key becomes convex in place of flat. Correctly speaking, a key should be proportioned so that everywhere it has an equal surface pressure and it will remain flat.

Where there is no pressure there should be no material, and a theoretical flat key would be perforated with diamond-shaped holes as in Fig. 2, which is a plan of a key end, the hatched portions being cut through. An approximation to this theoretical key would be made by simply recessing these portions below the general surface. This would give the theoretical surface area but would leave an excess of material towards the middle of the key, which is the more wrong because the middle of the key is supported against flowing away by the outer portions that can flow themselves more easily.

These considerations naturally lead up to a key with the surface recessed as shown in Fig. 3 as cheaper than a perforated key and common sense in workshop practice would condemn this also as too costly, but the same sense would approve of the form of Fig. 4 which is a part plan of Fig. 1 and is a plain key with a parallel recess cut all down the middle, the effect of the recessing in Figs. 2 or 3 being got by the man who fits the extreme edge hard and eases off towards the recess. In large keys I think this recessing should always be done; it saves fitting and makes a pleasanter and better job. It reduces the resistance of a key to driving and puts it into an original compression before going into actual duty; which would be made manifest if further driving of keys were attempted after a few days running. Probably every one carries this system out more or less in fitting, endeavoring to secure better contact at the edges, but it ought to be carried out on the key before the fitter touches it; when the key is being planed or milled a deliberate recess of $\frac{1}{16}$" being put on both faces, about a third the breadth of the key being removed.

"I have just been figuring up what it will cost me to have an invention patented throughout the world," said a young Kansas City inventor, 'and I have found out. It takes a fortune. There are on this mundane sphere 64 governments that run departments devoted to fleecing the poor inventor, and pretend to give his idea protection. Sixteen of these sharks are to be found in Europe, 8 in Africa, 4 in Asia, 27 are on the two continents of America, and 9 are in Oceanica. Of course the charges differ in every case; some are comparatively small, others are not so small. In the aggregate they average about $227.35 each or a grand total of $14,550. That's a pretty sum for a man to spend to keep an idea from being stolen, isn't it?—*National Car and Locomotive Builder.*

Professor Blake, of the University of Kansas, in one of his University Extension lectures delivered at Kansas City, Mo., gives an interesting comparison between the light of the sun and the artificial light from electricity at the World's Fair. By Professor Langley's experiments on Mount

Whitney, the Professor states, 1.6 kilowatts of energy per square meter of earth's surface is received from the sun when vertical. As the energy received would vary as the cosine of the sun's altitude, this would average almost one kilowatt per square meter for different positions of the sun. Of this power only 35 per cent. is light. The area of the World's Fair grounds is 1,037 acres, or 4,200,000 square meters. To light this space by the sun will require 1,466,500,000 watts, or 1,965,000 H. P. In lighting the grounds by electricity 5,200 arc and 90,000 incandescent lamps will be used, according to statements in *The Electrical World*, which will require 14,200 H. P. So that the sun expends about 140 times more energy to light the World's Fair grounds than man.—*Electrical World.*

A remarkable feature of the present situation is the continued favorable course of railroad earnings in spite of the great financial and business depression. A recent issue of the *Financial Chronicle* gave gross earnings for the month of May for 137 roads, with 95,809 miles operated. The increase in mileage over May of last year was about 1.8 per cent., and the increase in gross earnings was 8.94 per cent. For the five months ending with May, 135 roads, with about the same increase in mileage, showed a gain in gross earnings of 3.8 per cent. The same week *Bradstreet's* published reports for 134 roads, giving the increase in mileage for five months as 2 per cent., the increase in gross earnings 4 per cent., and the increase in gross earnings for the month of May 9.3 per cent. It is remarkable also that these increased earnings are exhibited by railroads scattered all over the country.—*The Railroad Gazette.*

The following questions that are to come before the Master Mechanics at their next convention are worth the consideration of inventors and manufacturers:

"Devices to facilitate the oiling of fast passenger engines when on long continuous runs; and effective cylinder lubrication with high-pressure steam."

"Special shop tools, either hand, power, pneumatic or electric, applied or applicable to locomotive manufacture and repair."

MANUFACTURES.

Parties propose to build a paper-mill at Warren-Ind.

The Roanoke (Va.) Carriage Works have been incorporated.

A cotton-mill company may be incorporated in Blackshear, Ga.

J. H. Abels is to erect a cotton gin and saw-mill at Rosedale, Miss.

The Hopkin's mill in Ellsworth, Me., is to undergo thorough repairs.

Graham, Gardner & Co. will establish a machine shop at Ocala, Florida.

An effort is being made to establish a $150,000 cotton-mill in Chattanooga.

The Lakeside Cotton-mills, Burlington, N. C., are putting in new machinery.

The Paris Mill and Lumber Company will build a planing-mill at Paris, Tenn.

The Prescott Watch Co., Waltham, Mass., is to increase its capital by $275,000.

Laramore & Freeman contemplate starting a knitting-mill at Cartersville, Ga.

J. M. Graham will erect a 40-barrel roller process flouring-mill at Pinewood, Tenn.

R. Coe and John Wilson, Selma, Ala., contemplate building a furniture factory.

The capacity of the Talbot Woolen-mills, North Billerica, Mass., is being enlarged.

The Hagar Straw Paper Co. has been formed at Cedarville, O., with capital $40,000.

The Florence Cotton-mills, Florence City, N. C., will add 7,000 spindles to its outfit.

A $50,000 stock company is being formed to build a cotton mill in St. Matthews, S. C.

Samuel H. Reifenider is to rebuild his flour-mill at Avondale, Ind., recently burned.

A 48x64 foot addition will be built to the Carpenter Steel Works at Reading, Pa.

An addition has been made to the carriage factory of Peck & White, Fall River.

Peter Madson will probably establish the manufacture of spokes at Enterprise, Miss.

The Chemical Paper Company, of Holyoke, Mass., is erecting a new mill building.

John Doscher and R. Brumann are erecting a paper box factory in Jersey City, N. J.

The Wisner Shoe Company, Bridgeport, Conn., is to remove its plant to South Norwalk.

The Cleveland (O.) Foundry Company will start on the erection of its new plant at once.

A cotton-mill will probably be erected at Wetumpka, Ala. H. B. Tulane is interested.

Endeavors are being made to organize a company to erect a cotton-mill at Sumter, S. C.

Hitch & Evans will rebuild their sash and blind factory recently burned at Knoxville, Tenn.

R. L. Pruyn, Baton Rouge, La., is preparing to build a factory for the manufacture of sash.

The Cleveland (O.) Steel Casting Company is to build an iron and steel foundry to cost $9,000.

The new boiler for the Stanley Creek (N. C.) Cotton-mill has been received and put in place.

The Riovlet Mills at North Uxbridge, Mass., are to undergo general repairs and improvements.

The South Florida Iron Works Company will establish an iron foundry at its plant at Tampa.

The Scranton (Penn.) Iron Fence Company is erecting a new plant and increasing its capacity.

The Boston Rubber Shoe Company, of Malden, Mass., proposes building a $4,000 brick boiler house.

The Patterson Manufacturing Company has been organized to erect a cotton-mill at Concord, N. C.

G. H. Waters & Son will enlarge their wagon works at New Berne, Me., and put in new machinery.

J. Y. Gilcomb, of 1 Beacon street, Boston, Mass., contemplates erecting a knitting-mill at Attalla, Ala.

The Virtue Mill Company has been organized at Virtue, Tenn., to build a roller process flouring-mill.

J. L. Kinser and J. D. Huddle will erect a sash, door and blind factory and planing-mill at Bristol, Tenn.

The wall paper company, at Harriman, Tenn., has applied for a charter and will enlarge its plant.

H. H. Poland, of Tyler, Texas, is contemplating the erection of a large iron rolling-mill at that place.

The capital stock of the Orion Knitting-mills, Kinston, N. C., will be increased from $10,000 to $22,000.

The Beck & Corbitt Iron Company, of St. Louis, increased their capital stock from $200,000 to $300,000.

A cotton mill, to contain 400 looms, will be built at King's Mountain, N. C. P. S. Baker is interested.

J. E. P. Boxley, Glendora, Miss., is to erect a new saw-mill to replace one recently destroyed by a tornado.

A foundry and machine shop, to employ 25 hands, at Martinsburg, W. Va., will be built by John Fitz.

The Dewey Nail Company, of Palmer, Mass., is establishing a branch of its nail works at Port Hope, Ont.

The W. F. Baker Carpet Company has been incorporated at Roanoke, Va., with a capital stock of $200,000.

A large brick addition has been made to the G. H. Gilbert Manufacturing Company's mill at Ware, Mass.

The Valley Foundry and Machine Works at Montgomery, W. Va., which were recently burned, will be rebuilt.

Rhodes Bros., of Ashton Mills, Pa., manufacturers of jeans, doeskins, etc., have made an addition to their plant.

Piedmont, Ala., is endeavoring to organize a $10,000 company to lease and operate the Piedmont Shoe Factory.

It is reported that the Donahoo Steel and Smelting Company will establish a plant in or around Berkeley, Cal.

The Leonard Bratt Lumber Company is erecting a 40,000-foot saw-mill, dry kilns and planing-mill at Lester, Ark.

The Standard Oil Company will erect at Attleboro, Mass., a plant to supply both that village and North Attleboro.

Lehman Stern & Co., New Orleans, La., will erect a new building, and add new machinery to the Lane cotton-mill.

It is probable that the new Empire Shirt Factory at Warrensburg, N. Y., will be enlarged considerably this summer.

An addition, 30x28 feet, has been recently made by E. E. Hilliard & Co., to their woolen-mill at Manchester, Conn.

J. M. Bower, of Decatur, Ill., is organizing a $100,000 company to manufacture pressed brick at Urbana, same State.

The Taunton (Mass.) Street Railway Company has purchased land for a new power house, which will be built at once.

The Mt. Vernon (Ill.) Car Manufacturing Company will increase its capital $50,000 for the purpose of enlarging the plant.

Plans are being made for a new tannery for the William Zahn Leather Company, at Newark, N. J. The new building will be 200x45 feet, and is to be erected as soon as the plans have been approved by the company.

W. C. Evans, W. H. Lewis and others have incorporated the Meridian (Miss.) Machine Shops, maximum capital $100,000, to manufacture presses, engines, boilers and all kinds of machinery of wood, iron, brass, etc.

Harrison Vaite, architect, has prepared plans for the large additional mill which the Old Dominion Cotton mills will erect at Manchester, Va. The building will be 40x60 feet in size, and F. Rolin has the contract to erect it.

The Allingham Boiler Company, of Minneapolis, Minn., capital stock, $100,000, has been organized for the manufacture of boilers and heating devices, cast, wrought and sheet-iron work. James Allingham of that place can inform.

Jones & Laughlins, of Pittsburgh, Penn., are erecting a large plate-mill addition to their plant. The new continuous mill which is being constructed on the site of the old nail mill is almost finished, and will be ready for operation soon.

The Wheeling (W. Va.) Steel and Iron Company proposes to immediately improve its Rockwood steel and skelp departments, also rebuild and increase materially the capacity of its "Top mill," and reline and otherwise improve the Belmont blast furnace.

The Orion Knitting-mills, of Kinston, N. C., manufacturers of seamless hosiery, has increased its capital stock to $20,000, and will put in some additional knitting machinery during the summer. B. W. Canady is president, and J. F. Taylor, superintendent and treasurer.

G. W. Fifield, Lowell, Mass., has just completed plans for a new machine shop, to have a frontage of 250 feet, with an ell at each end of 120 feet, and giving a total ground area of 25,200 feet. The building will be three stories high, and have a total floor area of 59,000 feet.

The Francis Manufacturing Company was incorporated at Albany, N. Y., to manufacture loop hooks and eyes at Niagara Falls. Capital, $55,000. The directors are: Henry A. Francis, Geo. H. McMichael, Arthur Schoelkopf, A. C. Hastings, and Geo. H. Johnson, of Niagara Falls.

Landis Brothers, Waynesboro, Pa., issue a very fine "standard size" catalogue of universal grinding machines. It is very fully illustrated, a large number of detail cuts being employed for the purpose; it also contains cut and description of a boring mill manufactured at the works.

The High Shoals Company has been incorporated by Fred Oliver, R. M. Miller, Jr., and D. A. Tompkins, with a capital stock of $50,000. Its principal place of business is to be at High Shoals, Gaston County, and its purpose is to manufacture cotton and wool into thread and other fabrics, etc.

The Washington Foundry and Machine Shops, of Washington, Ga., have been purchased by G. E. Lyndon, W. T. Johnson and A. M. Adams. They propose to continue the business as the Washington Manufacturing Company. A new foundry and machinery will be added to the plant.

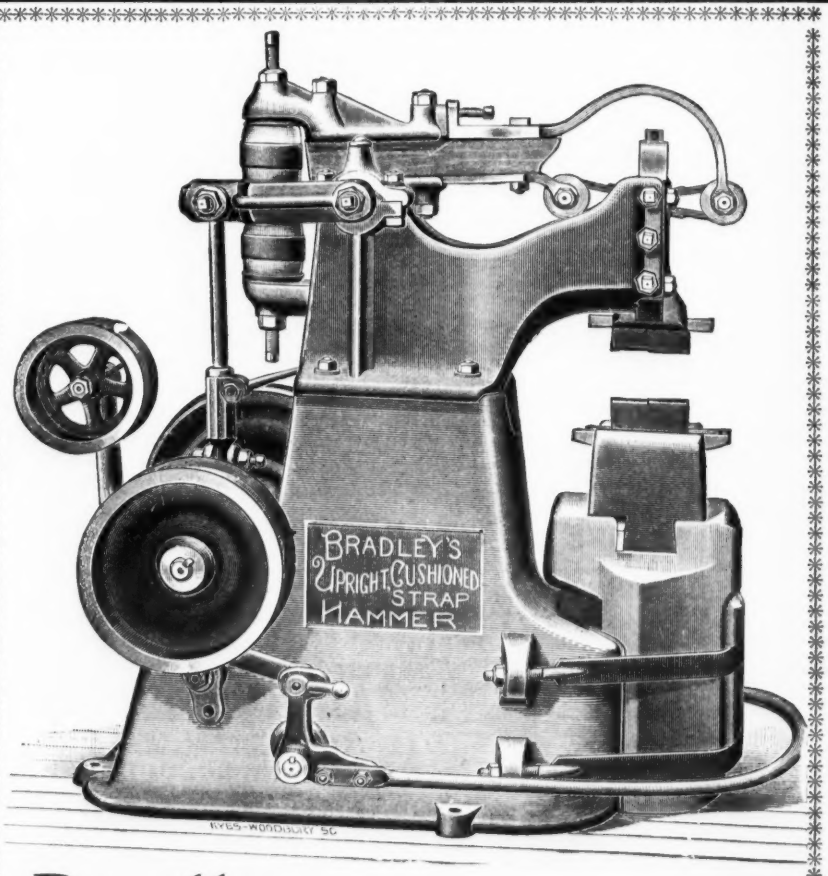
The mill building of the Newberry Cotton-mills at Newberry, S. C., will be enlarged very soon. The plant is now operating 11,000 spindles, which equipment is to be increased to 25,000. These improvements were decided upon at the stockholders' meeting in May, as previously noted. The improvements will all be completed within a year.

The New Hartford Leather Company has been incorporated to carry on the business of tanning and manufacturing of leather, and the manufacture of leather pocket-books and leather novelties in New Hartford, Oneida County, N. Y. Capital is $8,000. The directors are Rouse B. Maxfield and Fred W. Sessions, of Utica, N. Y.; Albert P. Seaton and Humphrey A. Williams, of New Hartford, and Geo. W. Chadwick, of Chadwick Mills, N. Y.

Two more new furnaces have been added to the equipment of the blooming mill department of the Edgar Thomson plant at Braddock, Pa. They are built on the plan of soaking pits, the ingots being charged vertically instead of horizontally. Each furnace has four doors operated by a separate hydraulic device for each door, while the charging and drawing is done by overhead cranes. The capacity of each furnace is 16 ingots or 30 tons, and the heating is done by fuel gas.

The Philadelphia Engineering Works, Ltd., have under construction their special Corliss engines as follows: One 18x36 special Corliss engine for Penn. R. R. Co.; 22x48, Del. Co. Construction Co., Clifton Heights, Penn.; 12x30, Harrisburg School Board, Harrisburg, Penn.; 14x36, Trenton Cotton-mills, Gastonia, N. C.; 12x30, Chatham Mfg. Co., Elkin, N. C.; 16x42, Colorado City Glass Co., Colorado City, Col.; also 26x50x54 cross-compound condensing for Penn. General Elec Co.

Geo. V. Cresson has just completed the erection of an addition to his large shafting works at Germantown Junction, Pa. The new



Bradley Hammers.

If you plate, draw, square, taper or weld iron and steel, you need a Bradley Hammer.

If you swage, collar, spindle, or do any manner of die work, a Bradley Hammer will soon pay for itself.

That the Bradley is the best Power Hammer in the market has never been questioned. Our circulars illustrate, describe, give sizes and prices.

BRANCHES: 14 Warren St., New York. 96-98 Sudbury St., Boston.

BRADLEY & COMPANY, Syracuse, N. Y.

building is 108x244 feet, built of brick and iron, with a hip roof supported by iron columns, on the top of which are heavy girders on which travels an electric crane. This shop is designed for heavy tools and work. One tool is a lathe capable of turning 40 feet. Another is a large horizontal pulley lathe, a smaller tool is a 32-foot by 25-inch lathe. Other new tools will be added from time to time.

Articles of incorporation have been filed in Knoxville, Tenn., for the La Follitte Coal and Iron Company, with a capital of $2,500,000. A number of Eastern capitalists, together with H. M. La Follitte, of Sterling, Tenn., are at the head of the new enterprise. Fifty thousand acres of coal, iron and timber lands have been purchased in Campbell County, including the Big Creek Gap property, and electric plants are to be used in mining the coal. A number of coking ovens and iron furnaces will also be erected, and an industrial town, to be known as La Follitte, will be established on the company's property.

The D. Frisbie Company, manufacturers of the Frisbie elevators, of New Haven, Conn., have been reorganized and a new charter applied for. The new company will be known as the Frisbie Elevator and Manufacturing Company, and the capital stock will be $70,000, all fully paid up. The company will start in at once to improve and extend their works. A large amount of new machinery is to be purchased, and other facilities are to be added, so that they can greatly increase their capacity for producing goods. It is said that they also contemplate the building of a Western factory. The company owns a large number of patents pertaining to elevators and hoisting machinery, one of the most important being the new direct electric elevator, the invention of W. H. Frisbie. They also make a friction clutch well known throughout the trade.

The Hinson Car Coupler Company, of Chicago, and the Southern Malleable Iron Company, of Chattanooga, have consolidated, thereby increasing the capital of the latter company from $200,000 to $2,800,000. The consolidation means the addition of much valuable machinery which enters into the manufacture of car couplers, and to accommodate the new machinery a large building will be erected. Additions of considerable import are also decided upon for the pattern department. The company proposes to add to the product of the old concern ten thousand car couplers per month, and will increase the capacity as the demand for malleable iron in general and car couplers in particular increases. Members of the company affirm that it is their belief 20,000 couplers per month will be the product of that one branch ere the end of the year '94.

Machinists' Supplies and Iron.

NEW YORK, July 8, 1893.

Iron—American Pig—We quote Standard Northern brands, No. 1 Foundry, $14.50 to $15.00; No. 2, $13.50 to $14.25; Gray Forge, $12.25 to $12.50. Southern brands of good quality are obtainable at $13.75 to $14.50 for No. 1 Foundry; $12 50 to $13.50 for No 2 and $11.75 to $12.50 for Gray Forge.

Antimony—The market is slightly lower. We quote L. X., 10.20c. to 10¼c.; Cookson's, 10.35c. to 10½c.; Hallett's, 9 85c. to 9⅞c., and U. S. French Star, 10½c.

Copper—The market is weak. Lake Copper is freely offered at 10½c. on spot, but no business is reported. Casting Copper is held at 9⅞c. to 10c.

Lead—The market is strong and advancing. Considerable business is reported at 3 50c. to 3.65c.; holders are now asking 3.75c. to 3.80c. for spot.

Lard Oil—Prime City is quoted at 73c. to 74c.

Tin—The market is easier. There are offerings at 18.85c. for spot; July at 18 90c., August at 19.30c., and September at 19.50c. Private sales are reported at lower figures.

✲WANTED✲

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Wanted—Pos. as sup't of mach. works, by a prac. mach. & draftsman; age 32. "Energetic," AM. MACH.

Wanted—Position as foreman boiler maker; 12 yrs'. exp.; ref. A1. A. M. P., Box 92, Roanoke, Va.

Practical machinist, gear cutter, theory, wishes a change. Address Box 27, AMERICAN MACHINIST.

American, middle aged, 10 years' experience foreman and superintendent, desires position; general mill furnishing preferred. Box 28, AM. MACHINIST.

Wanted—An experienced draftsman on electric crane work. Address, stating experience, and salary expected, Crane, AMERICAN MACHINIST.

Draftsman desires position; age 25; experience, power cranes, engines, pumps and special machinery. Address Box 19, AMERICAN MACHINIST.

Wanted—Position as draftsman by young man with 3 years' shop and 3 years' drawing-room experience. Box 32, AMERICAN MACHINIST.

Wanted—Position as foreman in iron foundry. Ten years' experience. Best of reference furnished. Address Box 145, AMERICAN MACHINIST.

Wanted—An energetic young man as foreman in machine shop of thirty men. Work, general repairs, including stationary engines. Address H. A. Bowen, 4427 Sherman Street, Chicago, Ill.

Wanted—Tool makers accustomed to jig and fixture work: permanent employment and good wages to men familiar with this line of work. Wardwell Sewing Machine Co., Woonsocket, R. I.

Shop agents for Carr's surface gauge and key rule clamps; liberal discounts; send for circulars; 2,000 gauges sold in past six months The Hoggson & Pettis Mfg. Co., New Haven, Conn.

Wanted—A general foreman: must be familiar with the rapid and accurate production of interchangeable metal parts; experienced in bicycle mfg. preferred. The Black Mfg. Co., Erie, Pa.

Wanted—Able mechanic to handle men and automatic machines (on goods similar to screws) in Chicago. Must be A1 executive. State wages desired. Address "Automatic," AM. MACHINIST.

Draftsman and machinist, with technical training, desires a change. Familiar with Corliss and high speed engines, pumps, and gen. mach'y. New York, or vicinity, pref'd Draftsman, AM. Mach.

Young man of 25 desires position in New York, or vicinity, experienced on special tools, jigs and fixtures, and also had charge mfg. dep't on fine interchangeable parts and screws. X., AM. MACH.

Wanted—An energetic, reliable young man as ass't to master mechanic; must be good mechanic, and well informed on general machine work. H. A. Bowen, 4427 Sherman St., Chicago, Ill.

Wanted—Position as foundry foreman, who is accustomed to all classes, engine, mill, mining, water-works, castings, light and heavy, 20 years as foreman in foundry. Box 29, AM. MACHINIST.

Wanted—A position by a young man who understands bookkeeping, drafting and light machine work. Can furnish references. Address B., Box 31, AMERICAN MACHINIST.

Wanted—Pos. as foreman or sup't by young man of 10 years' exp. as foreman & sup't of large shops building automatic & farm eng., & doing gen. repairs. Am accustomed to piece-work prices, & to close interchangeable work. J. M. J., AM. MACH.

Draftsman and designer open for engagement in any responsible position. Exp'd in modern shop and drafting room practice, design of special tools, jigs, etc., for mfr. of high grade interchangeable mach'y. Can estimate, supt'd construction & erection. Elec. mach'y pref'd. Box 30, AM. MACH.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d hd lathes & planers. S. M. York, Clev'd, O.

Auto. Steam Flue Cleaners. Kelley Co., Erie, Pa.

For Sale—Second-hand drill presses, engine lathes & planers. Dietz, Schumacher & Co., Cincinnati, O.

Light and fine machinery to order: Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

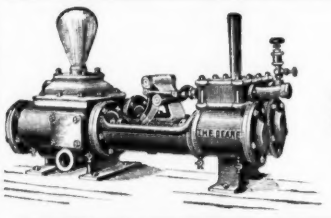
Best Bolt Header in the world for $50. Address C. H. Baush & Sons, Holyoke, Mass.

For Sale—A machine shop fully equipped; invoice about $2,500, can be purchased at a bargain if sale is made within 30 days. H F. Quickel, Harrisburg, Pa.

Wanted—Partner in an iron foundry in St. Louis, Mo., with $1,000 to $5,000. Write J. McCash, 619 Harris Ave., St. Louis, Mo.

Rubber, metal, and composition patterns & small rubber and metal work for carding and grouping, to order. John T. Usher, 116 E. 54th St., New York.

We will pay 50 cents each for copies of the AMERICAN MACHINIST of December 4, 1886 issue, must be unsoiled and in good condition. AMERICAN MACHINIST PUBLISHING COMPANY, 203 Broadway, New York.



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STEAM PUMPS
DEANE STEAM PUMP CO.,
HOLYOKE, MASS.

CRESCENT STEEL CO.
PITTSBURG, CHICAGO, NEW YORK.
STEEL FOR Lathe and Planer TOOLS, Cold Chisels, Punches & Dies, Milling Cutters, Molding Bits, &c.
SHEET STEEL, POLISHED Drill Rods, SPRING STEEL, Machinery Steel, COILED SPRINGS, Steel Forgings, ETC.

A NEW SCREW PLATE.

THE HANDIEST PLATE MADE.
THE FULL MOUNTED LIGHTNING.
These Plates have a stock with each die. The dies are our celebrated Adjustable Lightning Dies. Each Stock is of correct length and weight to suit size of die. Several sizes of dies may be in use out of same set at same time. SEND FOR CATALOGUE. Made by
WILEY & RUSSELL MFG. CO.,
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proves the quality of valves more effectually than all the arguments of the salesman.
The MASON REGULATOR CO., of BOSTON
can refer intending purchasers of valves to parties who have used their goods for years.

"R. MUSHET'S SPECIAL STEEL"
SAVES LABOR in being able to run at GREATLY INCREASED SPEEDS. FEWER GRINDINGS. No WASTE in redressing.
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I have laid aside one thousand copies of my Gear Book, which is a short but usually sufficient treatise on gear wheels and gear cutting, and will send them free of charge to the first thousand machinists, apprentices, or machine using business concerns applying for them. Give full address. If a workman, name concern you are working for.
GEORGE B. GRANT,
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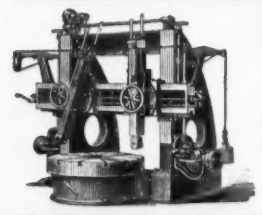
SEBASTIAN LATHE CO.
117 & 119 Culvert St., Cincinnati, O.
Manufacturers of Foot and Power
ENGINE AND SPEED LATHES,
For General Machine and Jobbing Shop, Electrical and Experimental Work.
DEALERS IN MACHINISTS' TOOLS AND SUPPLIES.



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For Pattern Makers. 8 Sizes.
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Friction Pulleys, Clutches and Elevators,
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FOR TOOLS, DRILLS, DIES, &c.
ALL KINDS IN STOCK.
Manufactory, SHEFFIELD, ENG.
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Established a century ago.

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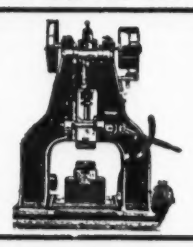
Meet all requirements more fully and satisfactorily than any other of its competitors.
INVESTIGATION IS NOT COSTLY.
INVESTIGATION IS CONVINCING.
WRITE FOR CATALOGUE TO
THE HACKNEY HAMMER CO.
20 Johnson St., CLEVELAND, O.



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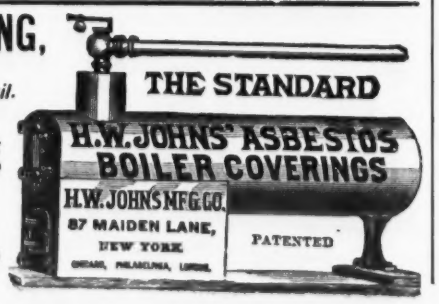
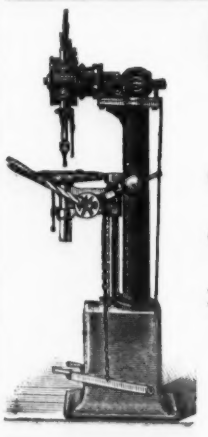
FOR LAGGING LOCOMOTIVE BOILERS.
Samples and Descriptive Price List Free by Mail.
We are prepared to take Contracts for applying Steam Pipe and Boiler Coverings in any part of the United States.
H. W. JOHNS MANUFACTURING CO.,
87 Maiden Lane, NEW YORK.





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Arranged for Light Tapping. Has these Advantages:
Power as applied is graduated to size of Drill.
SIX DRILL SPINDLES and only the one in use revolves.
Any speed instantly from 250 to 2,000 revolutions.
Drills and Taps without moving work.
Capacity from 0 to ½ inch.
SEND FOR CIRCULAR.
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VARIETIES FILES
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OFFICE AND WORKS:

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CHAS. M. JARVIS, Pres. and Chief Engineer. BURR K. FIELD, Vice President.
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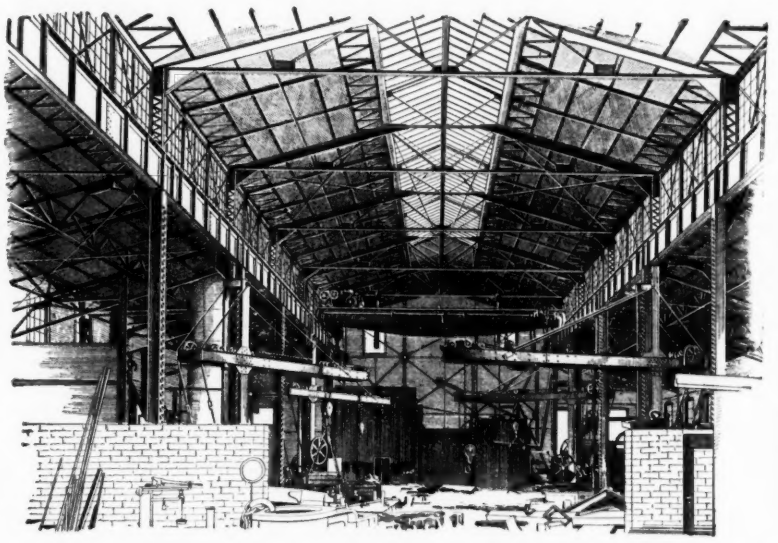
ENGINEERS, ARCHITECTS AND BUILDERS OF



IRON AND STEEL BRIDGES AND BUILDINGS.

The above illustration is taken direct from a photograph and shows the interior of a Foundry Building which was designed and built complete by us for S. F. Hodge & Co., at Detroit, Mich. Each wing is 24 feet in width and the central portion is 40 feet in width, this latter controlled by a crane with a travel the full length of the building. The crane girder posts are designed to carry jib cranes as shown. The roof is covered with our Patent Anti-Condensation Corrugated Iron. The building is absolutely fire-proof, and the Corrugated Iron is guaranteed not to drip during the coldest weather.

SEND FOR OUR ILLUSTRATED CATALOGUE.

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SPECIAL No. 8, makes a fine finish on the hardest Rolls; Boss Cold Chisel Steel; High Grade Twist Drill, Tap, Punch, Reamer, Wood and Milling Cutter Steel and Blanks.
The **HIGHEST QUALITY**; Inducements to the Trade and large Users.

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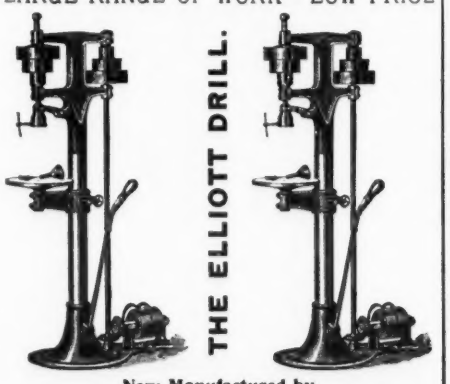
The Elliott Drill Press

FOR ANY LIGHT WORK

LARGE RANGE OF WORK - LOW PRICE



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Now Manufactured by
A. J. WILKINSON & CO.,
180 to 188 WASHINGTON ST., BOSTON, MASS.
SEND FOR CATALOGUE.

COOKE & CO.,

163 & 165 WASHINGTON ST.,
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ENGINES and BOILERS.

VERTICAL,
HORIZONTAL,
STATIONARY,
PORTABLE,
Plain and Automatic.

Write for Catalogue and mention this paper.

Machinists' and Boiler Makers' Tools,

NEW AND SECOND HAND.

(IN STOCK)

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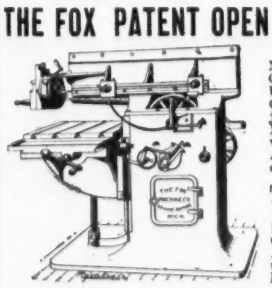

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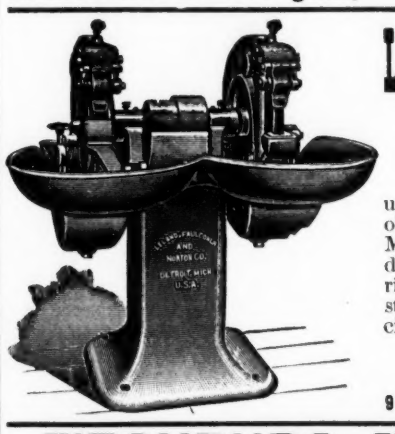

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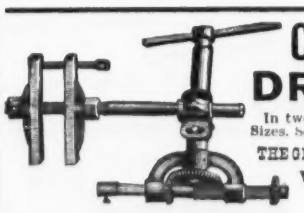

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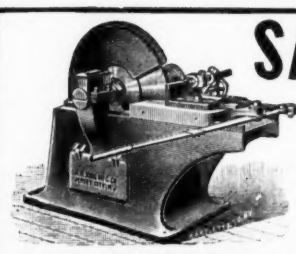

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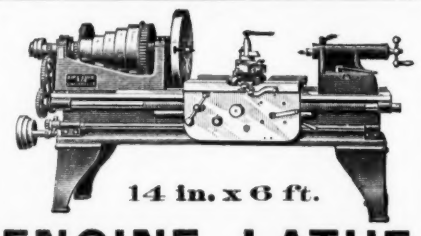

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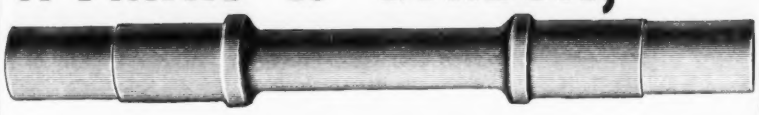

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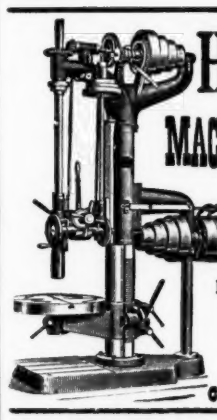

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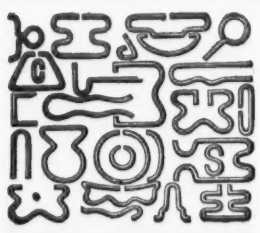

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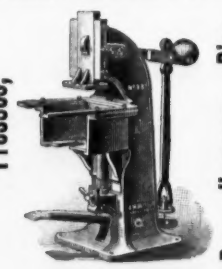

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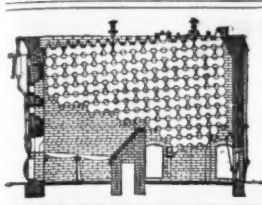

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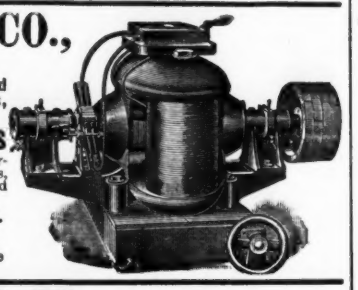

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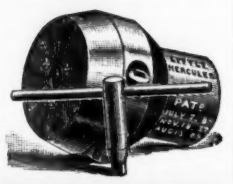

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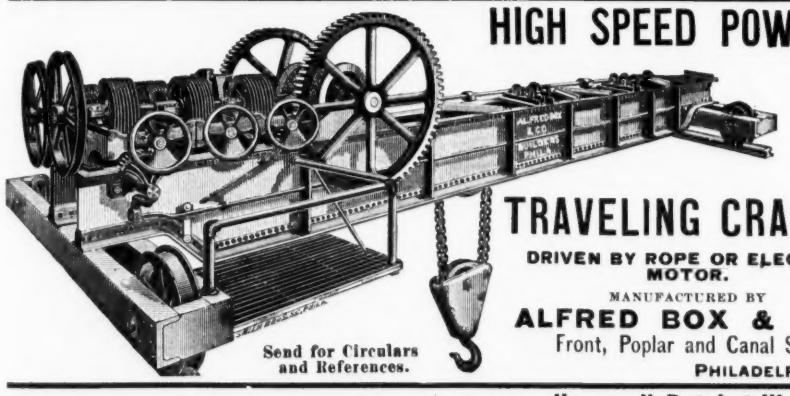

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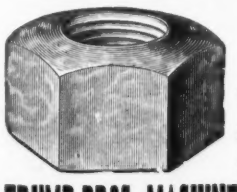

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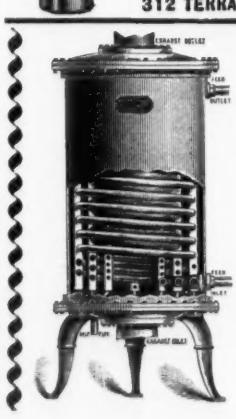

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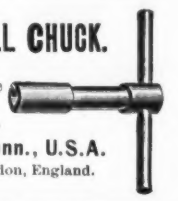

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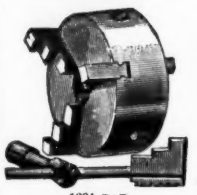

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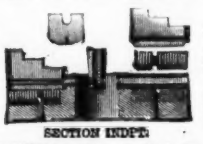

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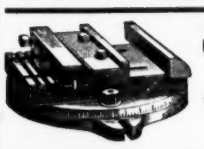

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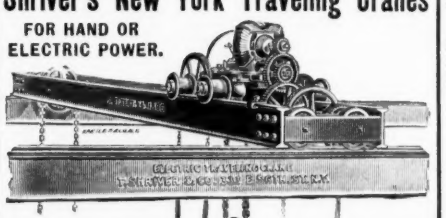

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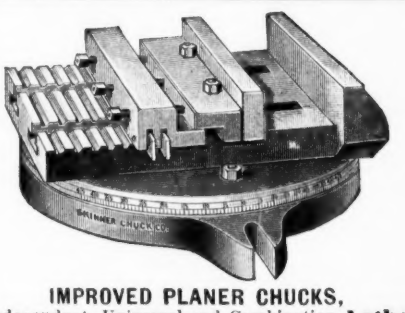

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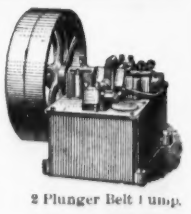

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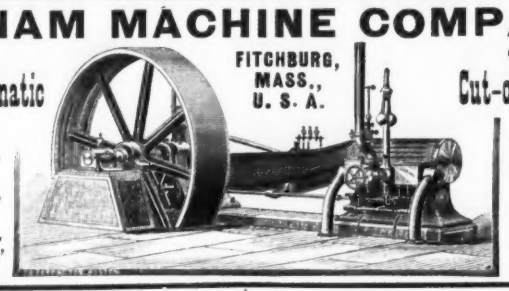

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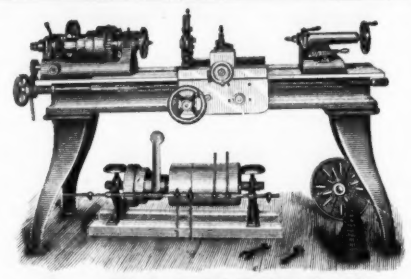

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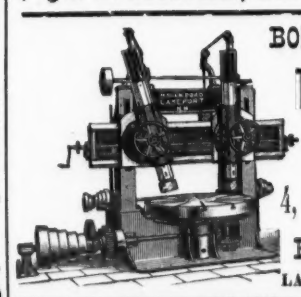

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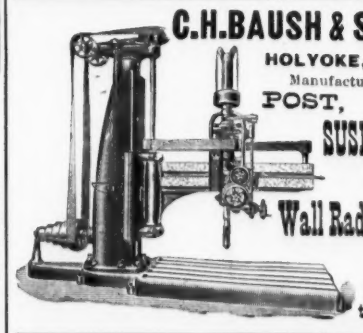

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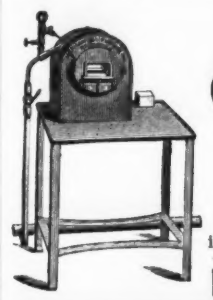

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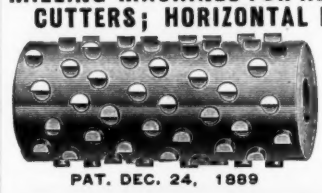

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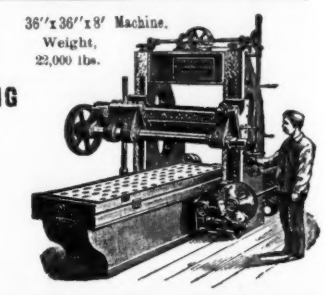

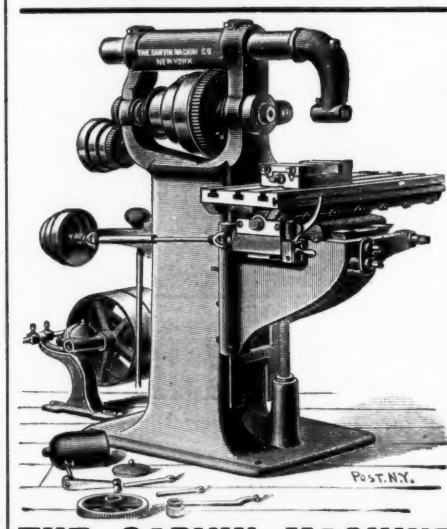

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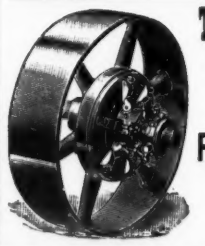

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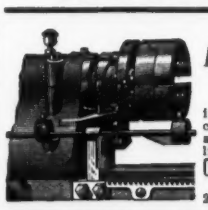

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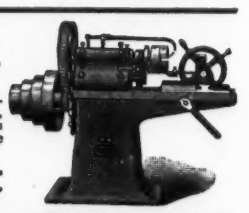

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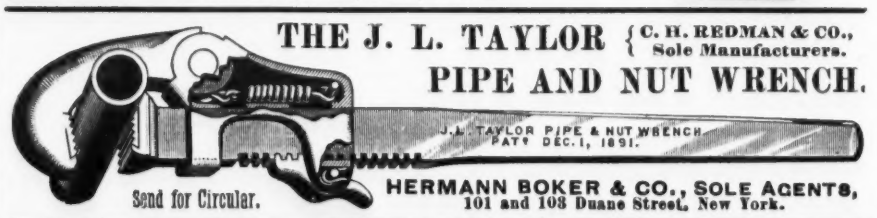

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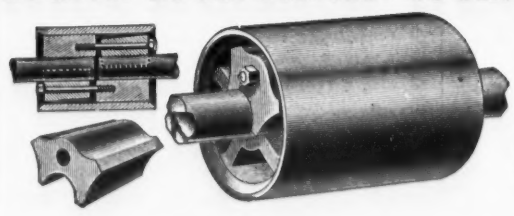

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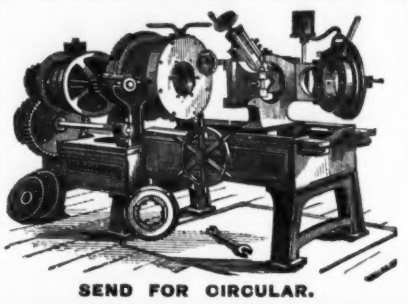

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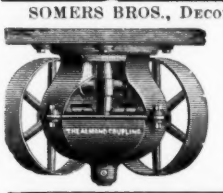

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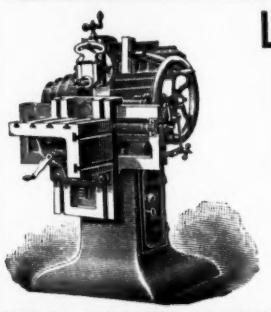

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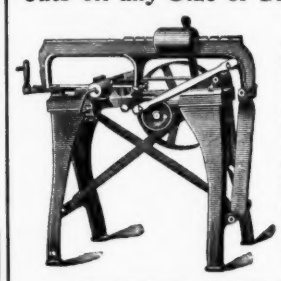

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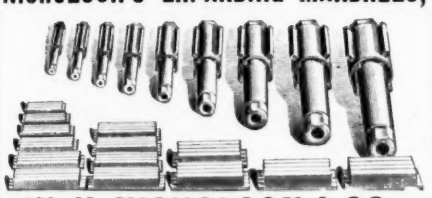

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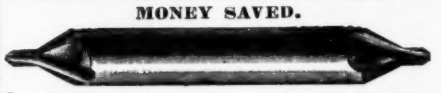

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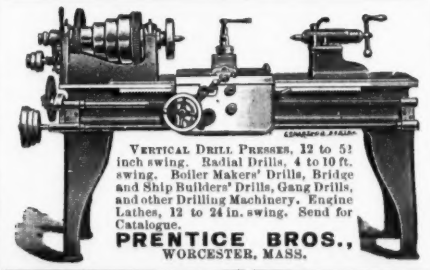

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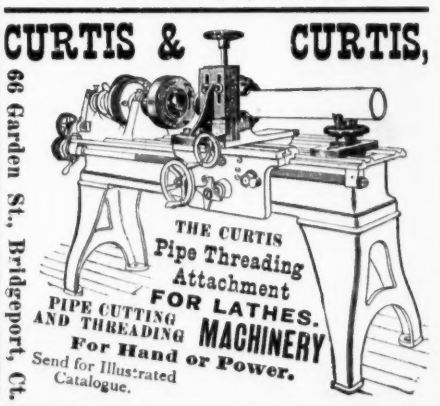

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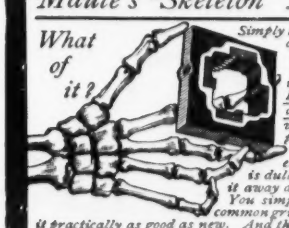

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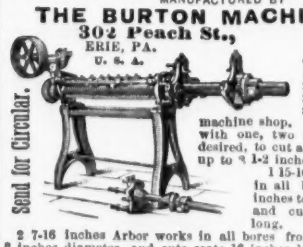

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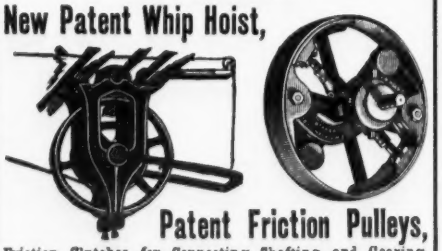

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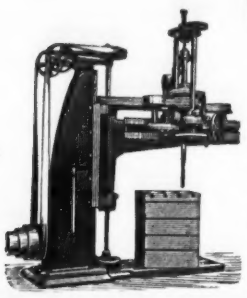

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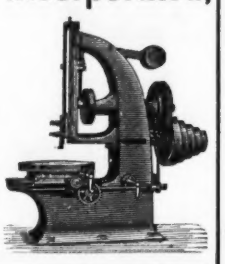

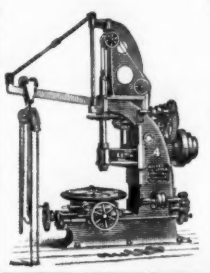

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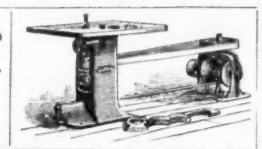

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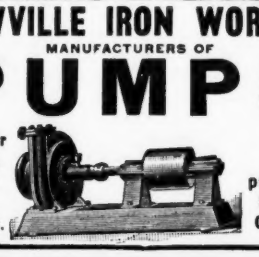

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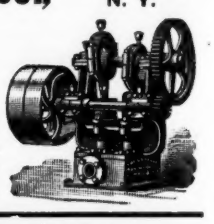

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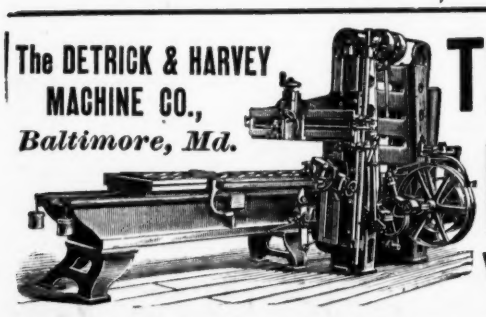

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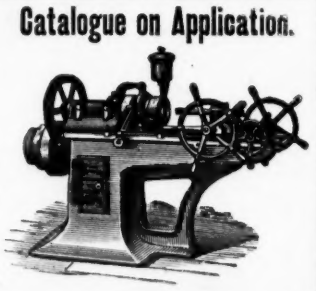

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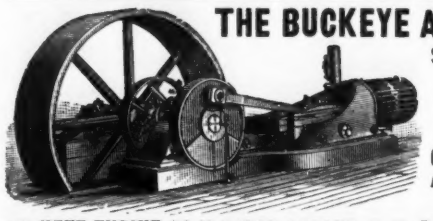

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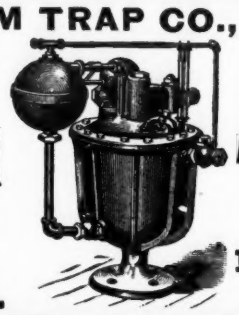

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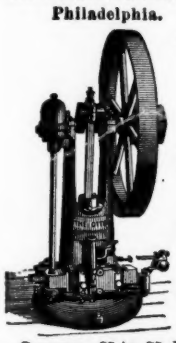

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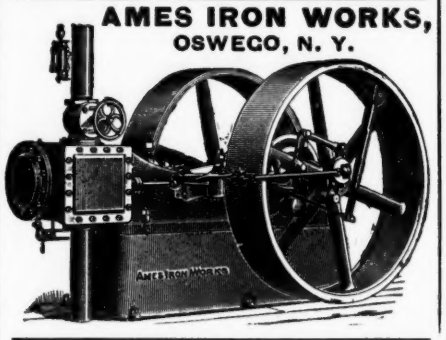

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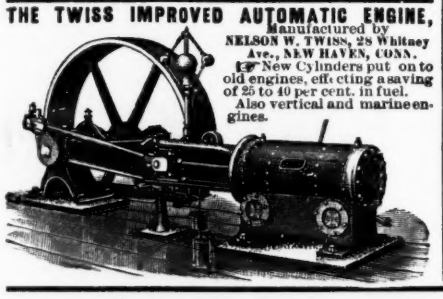

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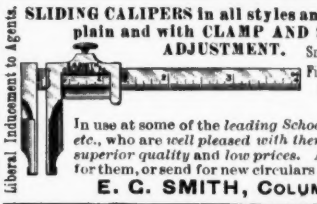

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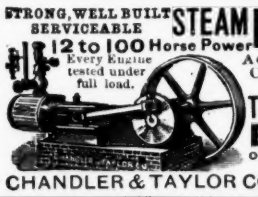

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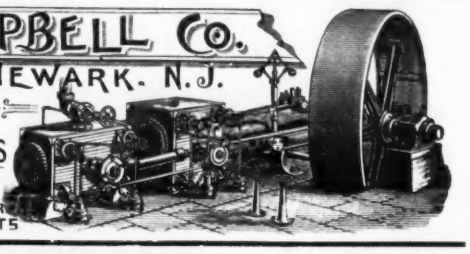

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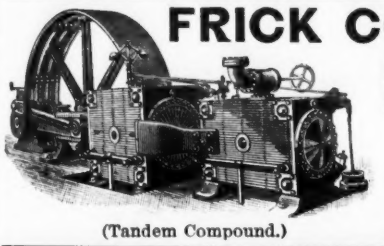

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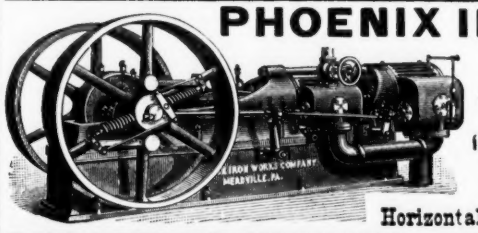

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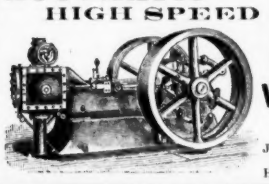

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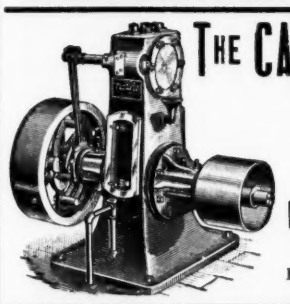

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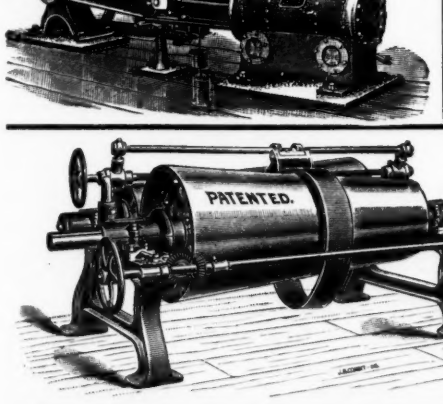

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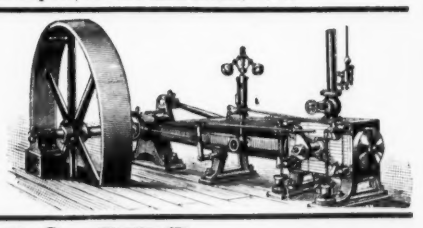

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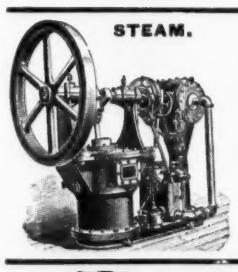

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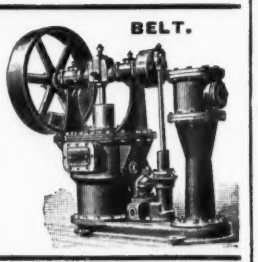

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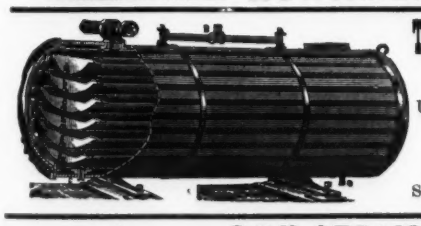

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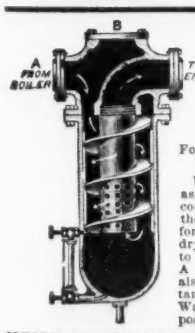

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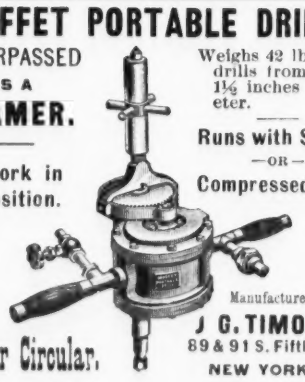

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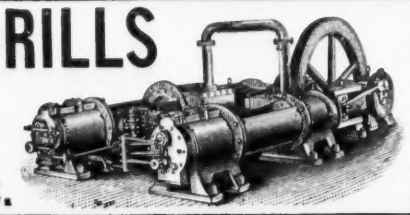

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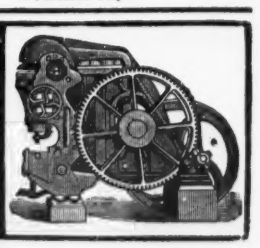

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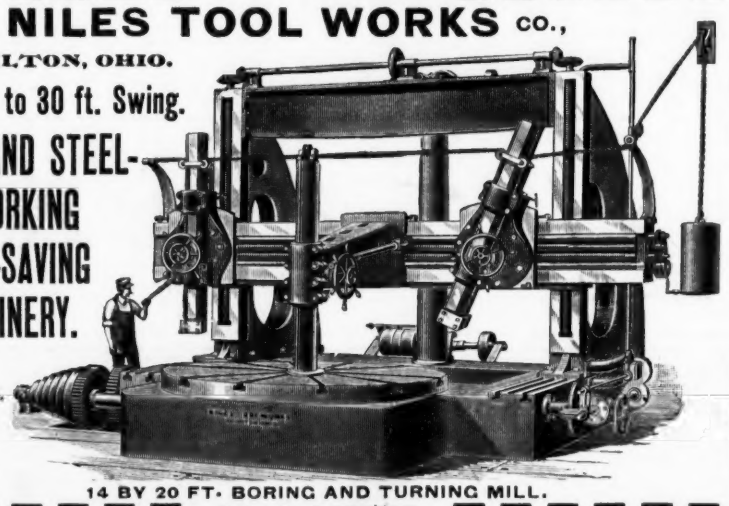

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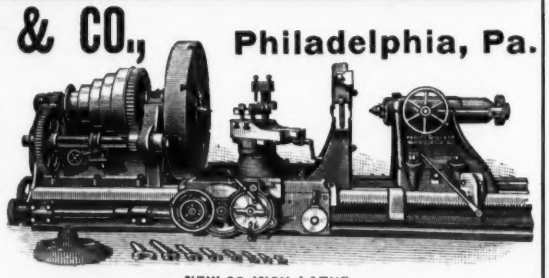

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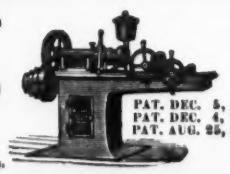

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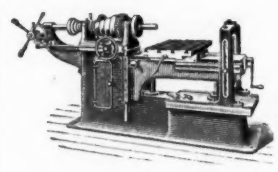

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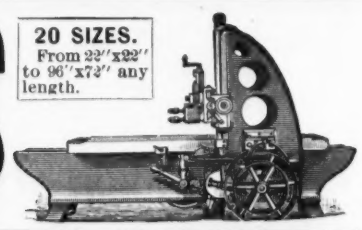

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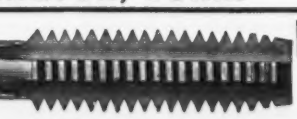

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